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C66-2191

Astronuclear

WANL-TNR-111

MAY, 1963

ASSEMBLY PROCEDURES
PHASE I VIBRATION
(CORE - INNER REFLECTOR)

[redacted]

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TABLE OF ILLUSTRATIONS

SECTION I
GENERAL

This document describes the procedures to be followed and the equipment necessary to perform the assembly of the phase 1 vibration Core and the Inner Reflector. It contains the sequence of operations and identifies additional documentation and supplementary information. The following assembly operations are covered in detail:

1. Orificing and preparation for instrumentation of the ELEMENTS.
2. Assembly of the CENTRAL FUEL CLUSTER and the REGULAR FUEL CLUSTERS.
3. Assembly of the IRREGULAR FUEL CLUSTERS.
4. Assembly of the CORE.
5. Assembly of the INNER REFLECTOR.
6. Assembly of the CORE and the INNER REFLECTOR.

These procedures are to be followed during the above assembly operations and are to be used as reference in conjunction with the following documents:

1. Valid drawings which define the parts, sub - assemblies and assemblies.
2. Instrumentation instructions.
3. Element placement and orificing directive.
4. Health physics manual .
5. Criticality Procedures.
6. Quality Control Operating Instructions.
7. Reliability Procedures.

8. Reactor Assembly Process Outlines (RAPO).

9. Process Specifications.

The Core and the Inner Reflector for Phase 1 Vibration is shown on Figure No. 1 - 1.

The flow of components during the assembly is shown on Figure No. 1-2.

* WARNING

OBSERVE THE HEALTH AND SAFETY PRECAUTIONS FOR HANDLING RADIOACTIVE MATERIAL AS OUTLINED IN THE CRITICALITY HAZARDS CONTROL GUIDE, WANL-TME-185. IN ADDITION THE REACTOR ASSEMBLY AREA CRITICALITY HAZARDS CONTROL PROCEDURES, RA-048 MUST BE OBSERVED.

* The above warning is not dictated by the presence of fissionable material ("fueled elements" in this reactor are made of graphite only). However, it is intended to assemble this Reactor with the precautions as if it contained radioactive material.

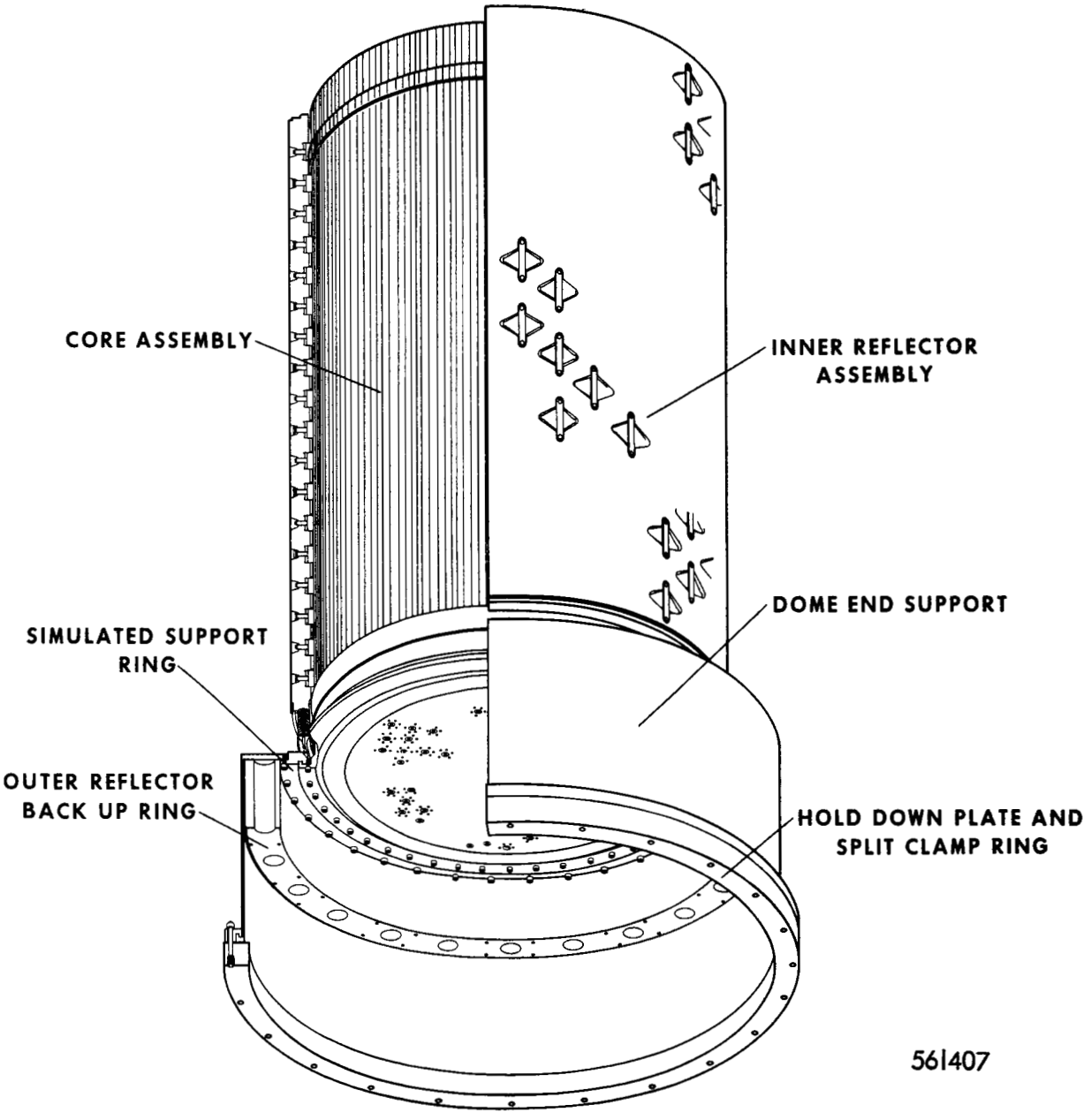

Figure 1 - 1 Core and Inner Reflector Assembly Phase 1 Vibration

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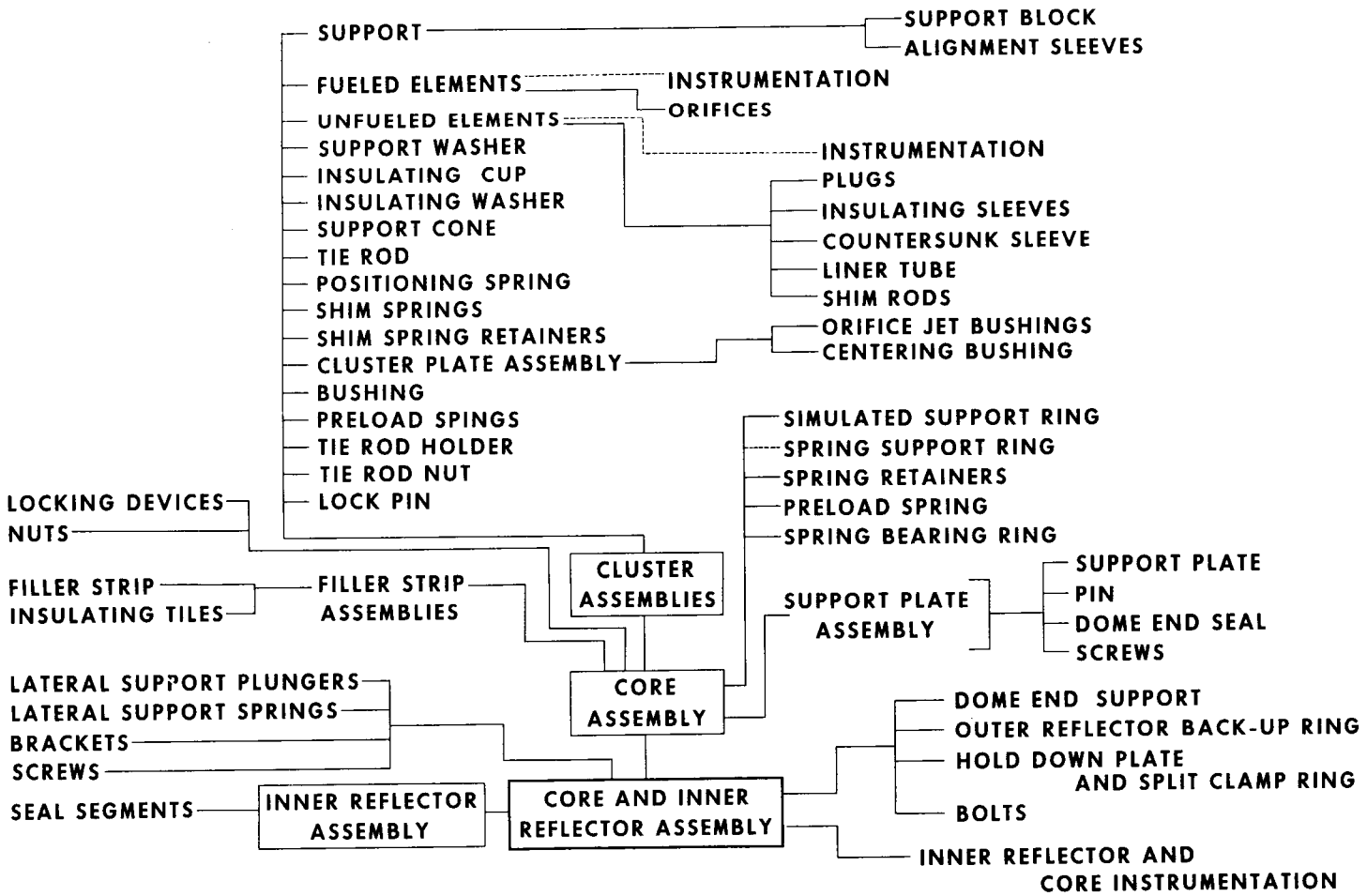

Figure 1 - 2 Assembly Flow Phase 1 Vibration

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SECTION II

GENERAL PREPARATION OF THE ASSEMBLY FIXTURES AND STANDS

The general preparatory function for each assembly operation should be as follows:

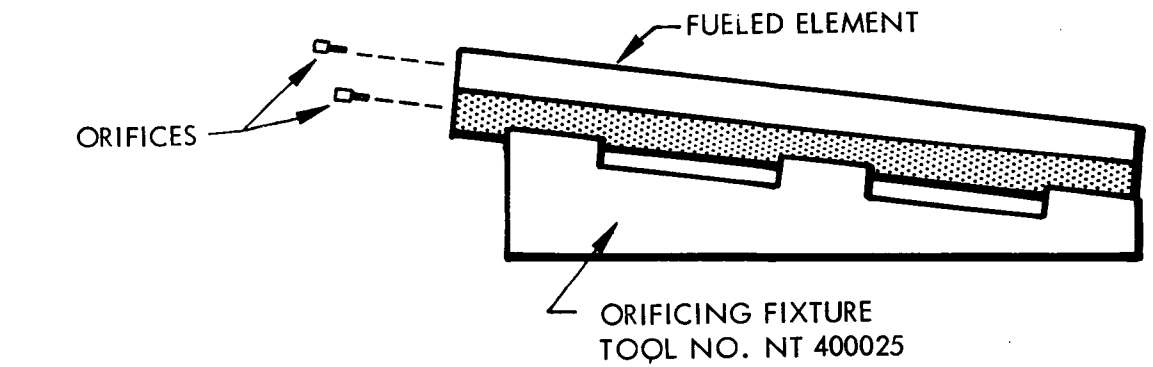
1. Remove all unnecessary items from the fixture and from the working area around the stand or fixture.
2. Examine the fixture for loose fastenings and tighten if necessary.
3. Examine the fixture working faces for nicks and damages and repair if necessary.

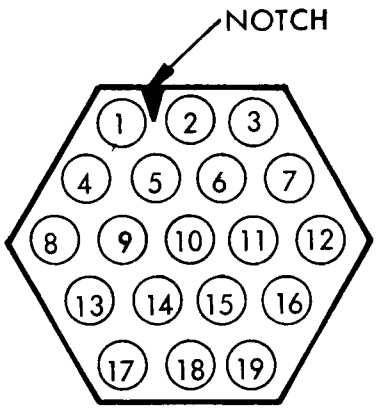
SECTION III

ORIFICING OF THE FUELED ELEMENTS

Refer to Figure No. 3-1

Install nineteen (19) orifices in every fueled element as outlined in the Reactor Assembly Procedure Outline, RAPO No. 1069 titled, "Fuel Element Orificing" and the "Element placement and Orificing Directive 963B736.





ORIFICE LOCATION

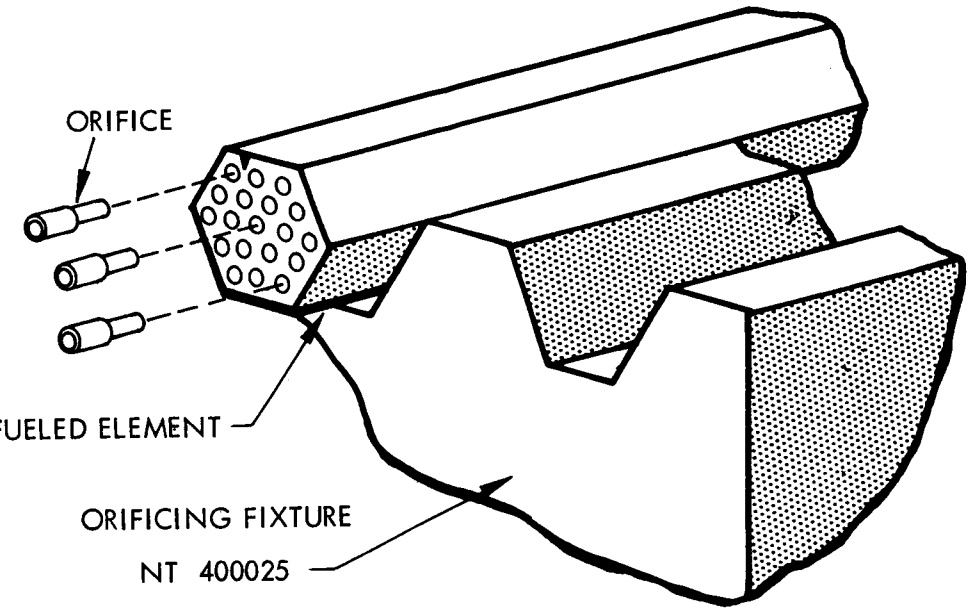


Figure 3 - 1 Orificing of the Fueled Element

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SECTION IV

INSTRUMENTATION OF THE ELEMENTS

Refer to:

TMI 661 - Instrumentation requirements for the E-1 Reactor Assembly Mechanical Test - Vibration.

TMI 663 - List of specific Instrumentation for the Vibration Test.

SECTION V

ASSEMBLY OF THE CENTRAL AND THE REGULAR FUEL CLUSTERS

PREPARATION:

WARNING

OBSERVE THE HEALTH AND SAFETY PRECAUTIONS FOR HANDLING RADIOACTIVE MATERIAL AS OUTLINED IN THE CRITICALITY HAZARDS CONTROL GUIDE, WANL-TME-185. IN ADDITION THE REACTOR ASSEMBLY AREA CRITICALITY HAZARDS CONTROL PROCEDURES, RA-048 MUST BE OBSERVED.

A complete set of the regular cluster and the central cluster drawings including instrumentation drawings, Element Placement and Orificing Directive, 963B736 and the applicable parts list should be available in the assembly area.

Refer to Figure No. 5-1

Prepare the ASSEMBLY FIXTURE Tool No. NT 600013 as follows:

1. Install the BACK-UP PLATE.
2. Install the POSITIONING PLATE and secure in place with the PIN.
3. Retract the POSITIONING PLATE GUIDE.

CAUTION

THE CORE CLUSTERS ARE MADE
FROM BRITTLE MATERIAL. HANDLE
WITH CARE.

ASSEMBLY:

For location of parts refer to Figure Nos. 5-2 and 5-3. For orientation of elements refer to Figure No. 5-4.

Refer to the following Reactor Assembly Process outlines:

RAPO NO. 1073	Central Cluster Assembly
RAPO NO. 1074	Regular Cluster Assembly

1. Assemble the SUPPORT BLOCK with the ALIGNMENT SLEEVES per Reactor Assembly Process Outline, RAPO NO. 1022" Cluster Support Assembly".
2. Place the SUPPORT in the ASSEMBLY FIXTURE with the serial number as shown on Figure NO. 5-4.

3. Insert the INSULATING SLEEVES, the COUNTERSUNK SLEEVE and the LINER TUBE into the UNFUELED ELEMENT or the UNFUELED ELEMENT(MULTIHOLE).

For shimmed clusters, in addition to the above parts, insert and cement and cure the PLUGS per Reactor Assembly Process Outline RAPO NO. 1070 "Multihole Unfueled Element Plug Assembly". Also, insert the negative SHIM RODS (or the positive shim rods) per Reactor Assembly Process Outline, RAPO NO. 1070 "Multihole Unfueled Element Shimming", the SHIM SPRINGS and the SHIM SPRING RETAINERS.

4. Assemble the orificed and instrumented FUELED ELEMENTS with ALIGNMENT SLEEVES in the SUPPORT and the UNFUELED ELEMENT or the UNFUELED ELEMENT (MULTIHOLE), with or without SHIM RODS, into the counterbore of the SUPPORT. The order of assembly of the elements in the regular cluster and in the central cluster is G, B, F, A, C, E and D.

5. Insert the SUPPORT WASHER and the INSULATING CUP into the SUPPORT. Engage the INSULATING CUP with the INSULATING SLEEVE.

NOTE

A LIGHT PRESS FIT MAY EXIST BETWEEN INSULATING CUP AND THE INSULATING SLEEVE.

6. Place the INSULATING WASHER into the INSULATING CUP and add the SUPPORT CONE on the TIE ROD. Insert the TIE ROD through the INSULATING WASHER and through the entire length of the LINER TUBE.

7. Assemble the CLUSTER PLATE, the ORIFICE JET BUSHINGS and the CENTERING BUSHING per Reactor Assembly Process Outline RAPO NO. 1071 "Cluster Plate Assembly".

8. Insert the POSITIONING SPRING and the CLUSTER PLATE ASSEMBLY over the TIE ROD in the orientation as shown on Figure No. 5-6, and engage all the ORIFICE JET BUSHINGS with the JET ORIFICES.

9. Insert the BUSHING and the PRELOAD SPRING over the TIE ROD.

10. Slide the TIE ROD HOLDER over the TIE ROD.

11. Align the flats on the TIE ROD HOLDER with the slot in the POSITIONING PLATE and compress the PRELOAD SPRING with the POSITIONING PLATE by turning the HANDLE counter-clockwise until the cluster length (the distance from the shoulder of the TIE ROD HOLDER to the bottom of the SUPPORT) equals 57.505^{+}_{-} .010 inches.

12. Thread the TIE ROD NUT onto the TIE ROD and at the same time prevent the TIE ROD from turning.

13. Insert the LOCK PIN through the TIE ROD and the TIE ROD NUT. Retract the POSITIONING PLATE all the way by turning the handle clockwise.

14. Remove the BACK-UP PLATE. Carefully remove the CLUSTER ASSEMBLY from the Assembly Fixture and place it on the table. Verify that the cluster length dimension does not exceed 57.515 $\pm$ .010 inches.

15. Carefully hand-carry the finished CLUSTER ASSEMBLY from the table to the CORE ASSEMBLY or STORAGE area.

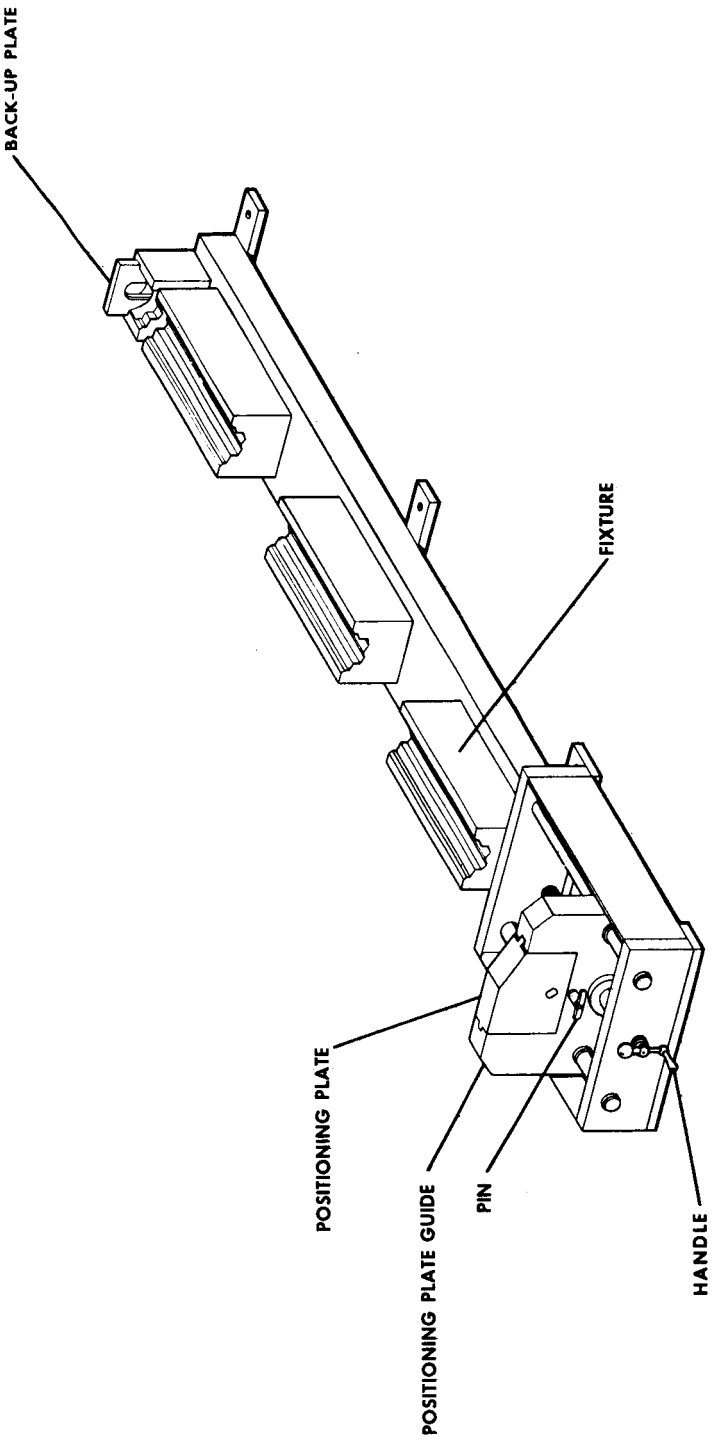

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Figure 5 - 1 Assembly Fixture Tool No. NT 600013

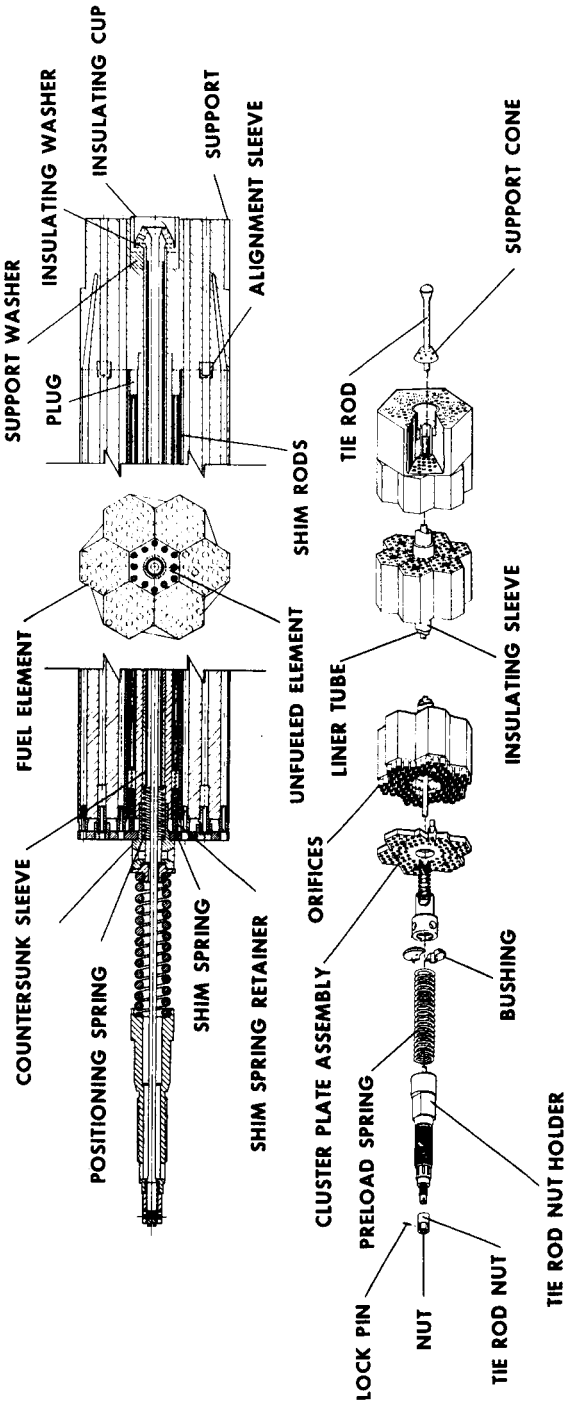

Figure 5 - 2 Control of the Regular Fuel Cluster

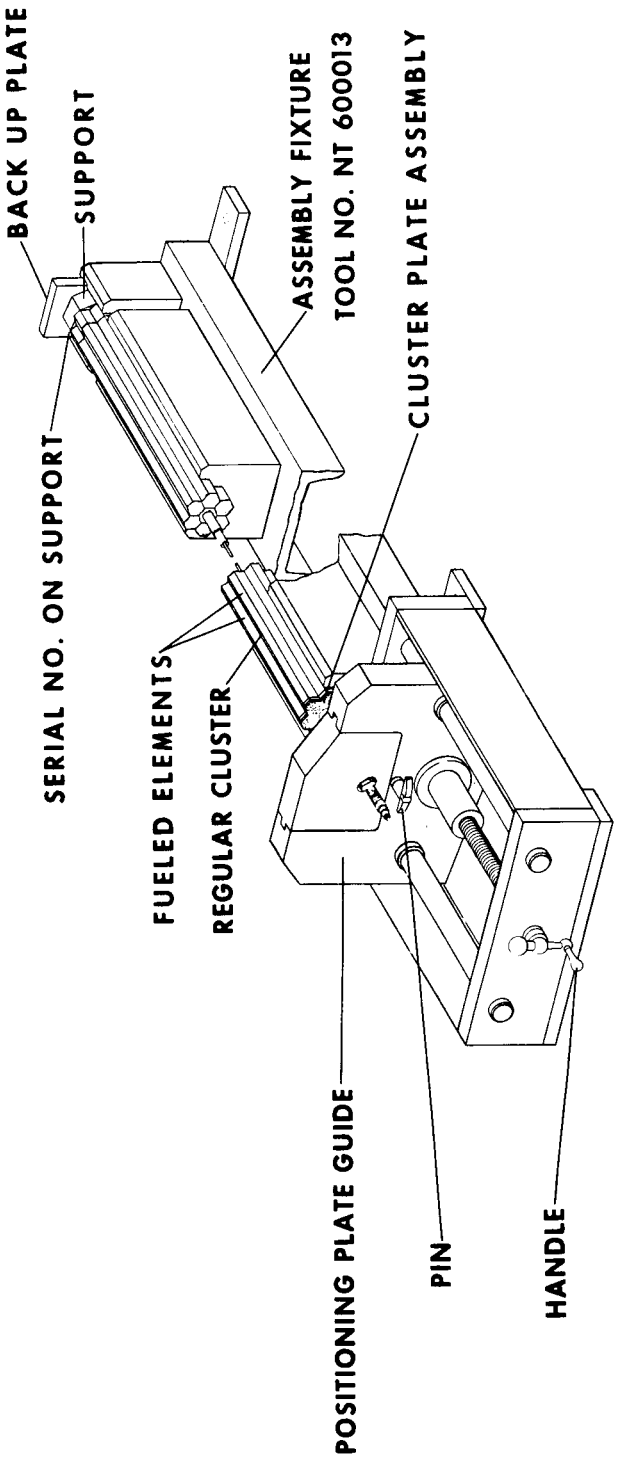

Figure 5 - 3 Assembly of the Central or the Regular Fuel Cluster

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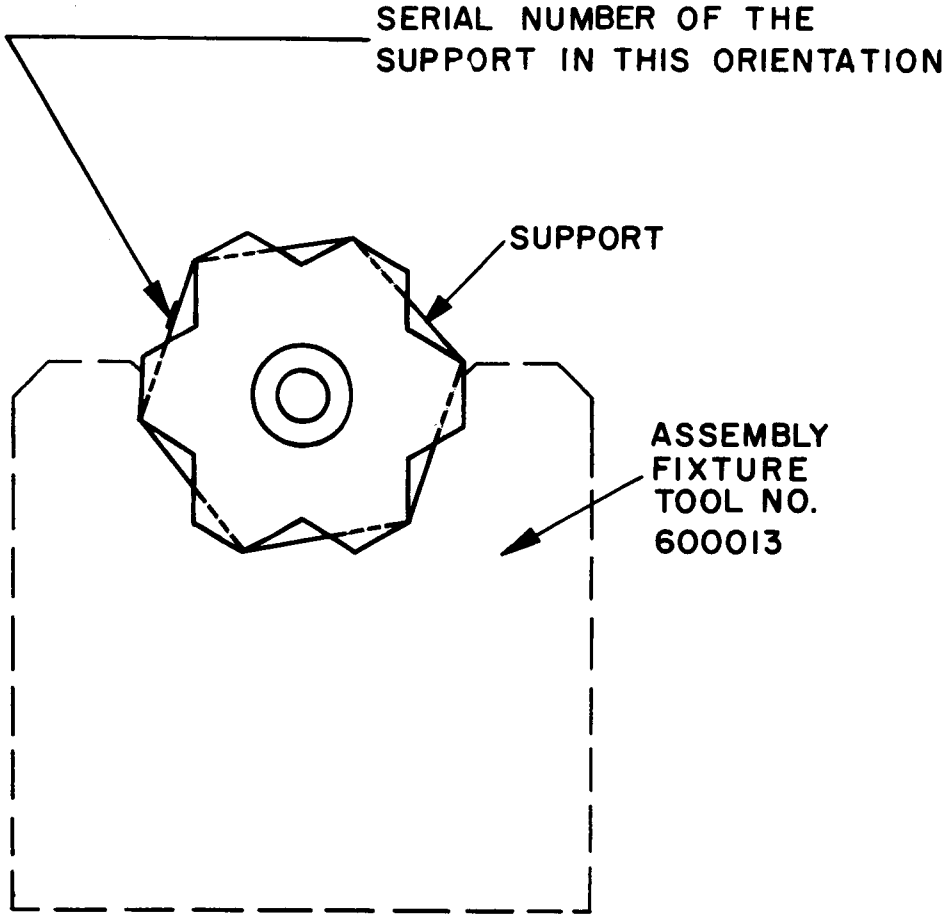

Figure 5 - 4 Dome End View Support Showing Serial Number Orientation

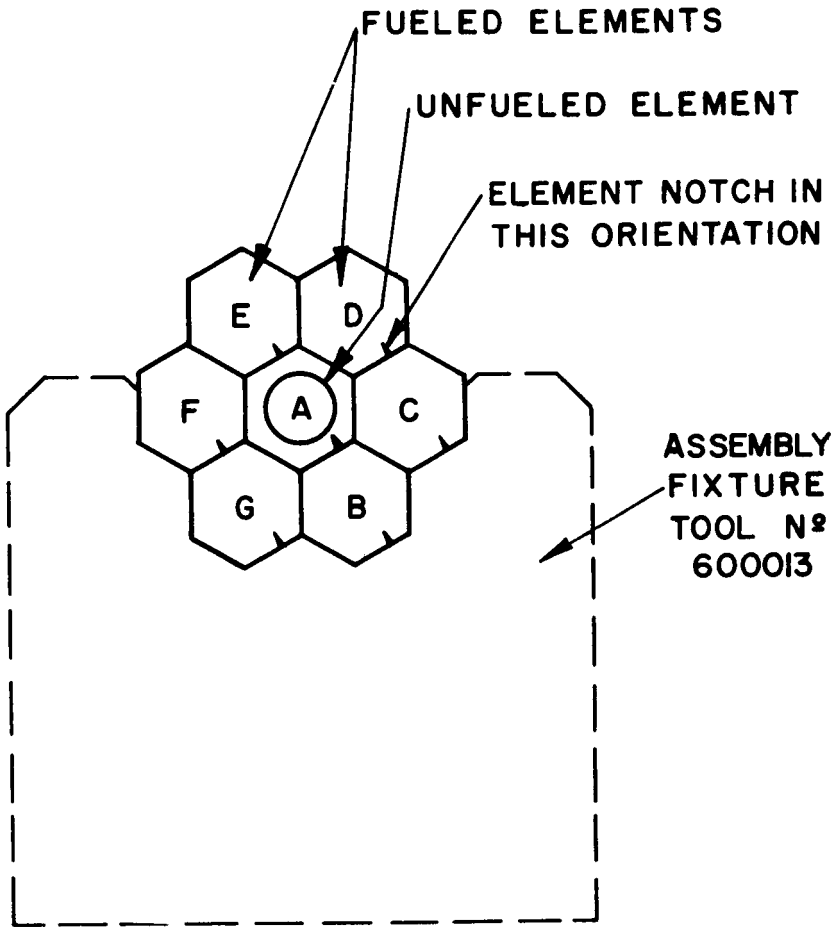

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Figure 5 - 5 Dome End View Central and Regular Fuel Clusters Showing Element Location and Orientation

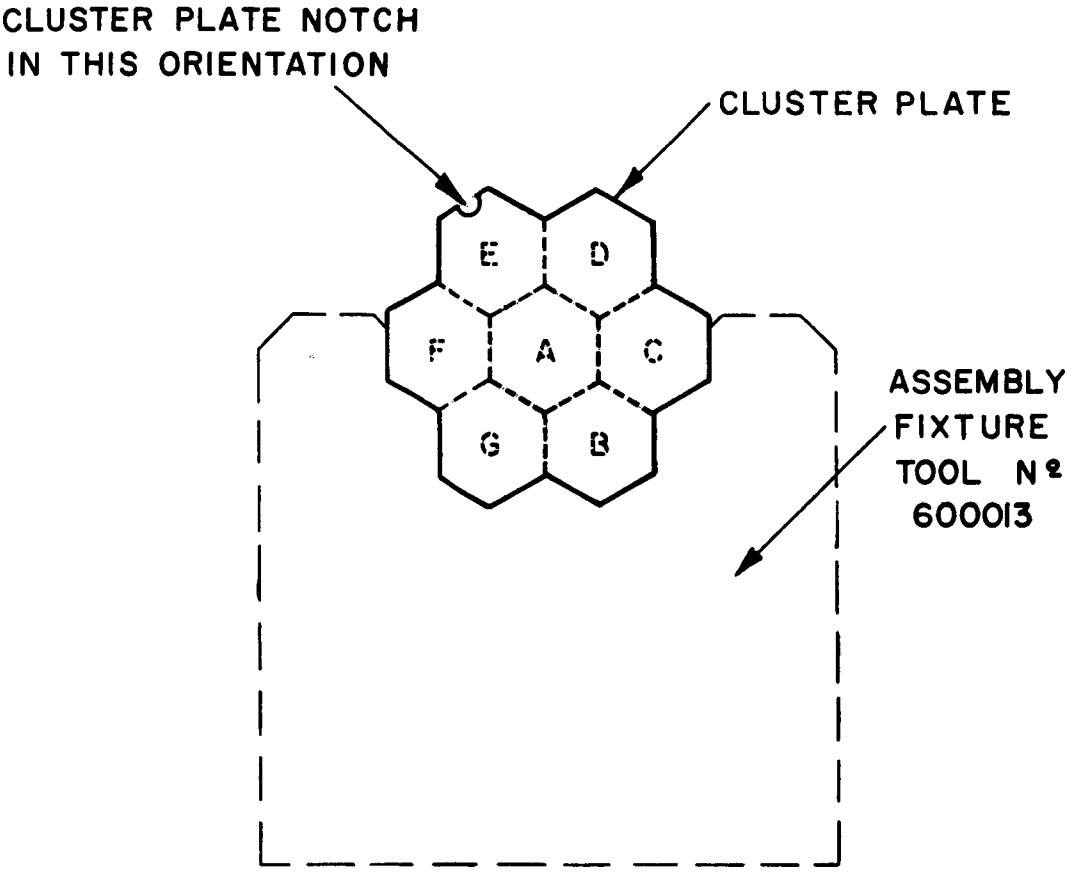

Figure 5 - 6 Dome End View Central and Regular Fuel Clusters
Showing Cluster Plate Orientation

SECTION VI

ASSEMBLY OF THE IRREGULAR FUEL CLUSTERS

PREPARATION:

WARNING

OBSERVE THE HEALTH AND SAFETY PRECAUTIONS FOR HANDLING RADIO-ACTIVE MATERIAL AS OUTLINED IN THE CRITICALITY HAZARDS CONTROL GUIDE WANL-TME-185. IN ADDITION, THE REACTOR ASSEMBLY AREA CRITICALITY HAZARDS CONTROL PROCEDURES, RA - 048 MUST BE OBSERVED.

A complete set of the irregular cluster drawings including instrumentation drawings, Element Placement and Orificing Directive, 963B736 and the applicable parts list should be available in the assembly area.

Refer to Figure No. 6 - 1

Prepare the ASSEMBLY FIXTURE Tool No. NT 600014 as follows:

1. Install the BACK-UP PLATE.
2. Install the POSITIONING PLATE and secure in place with the PIN.
3. Retract the POSITIONING PLATE GUIDE.

CAUTION

THE CORE CLUSTERS ARE MADE FROM BRITTLE MATERIAL. HANDLE WITH CARE.

ASSEMBLY:

Refer to Figure Nos. 5-3 and 6-2 for location of parts.

Refer to the Reactor Assembly Process Outline Procedures which are summarized as follows:

RAPO NO. 1034	for	J-3 CLUSTER ASSEMBLY
RAPO NO. 1035	for	J-4 CLUSTER ASSEMBLY
RAPO NO. 1036	for	J-5 CLUSTER ASSEMBLY
RAPO NO. 1037	for	J-6 CLUSTER ASSEMBLY
RAPO NO. 1038	for	J-7 CLUSTER ASSEMBLY
RAPO NO. 1039	for	J-8 CLUSTER ASSEMBLY
RAPO NO. 1040	for	J-9 CLUSTER ASSEMBLY

For orientation of ELEMENTS refer to the following Figures:

Figure No. 6-3	for	J-3
Figure No. 6-4	for	J-4
Figure No. 6-5	for	J-5
Figure No. 6-6	for	J-6
Figure No. 6-7	for	J-7
Figure No. 6-8	for	J-8
Figure No. 6-9	for	J-9

1. Assemble the SUPPORT BLOCK with the ALIGNMENT SLEEVES per Reactor Assembly Process Outline, RAPO No. 1022 "Cluster Support Assembly".
2. Place the SUPPORT in the ASSEMBLY FIXTURE.
3. Insert the INSULATING SLEEVES, the COUNTERSUNK SLEEVE and the LINER TUBE into each of the UNFUELED ELEMENTS or the UNFUELED ELEMENTS (MULITHOLE).

4. Assemble the orificed and instrumented FUELED ELEMENTS with ALIGNMENT SLEEVES in the SUPPORT and the UNFUELED ELEMENTS or the UNFUELED ELEMENTS (MULTIHOLE) into the counterbores of the SUPPORT. Assembly should begin with the lowest row of ELEMENTS and proceed in regular order row by row.

5. Insert the SUPPORT WASHERS and the INSULATING CUPS with the INSULATING SLEEVES.

NOTE

A LIGHT PRESS FIT MAY EXIST BETWEEN THE INSULATING CUP AND THE INSULATING SLEEVE.

6. Place the INSULATING WASHERS into the INSULATING CUPS and add the SUPPORT CONE on the TIE ROD at each point. Insert the TIE RODS through the entire length of the LINER TUBE at each TIE ROD point.
7. Assemble the CLUSTER PLATE, the ORIFICE JET BUSHINGS and the CENTERING BUSHING per Reactor Assembly Process Outline, RAPO no. 1071 "Cluster Plate Assembly".
8. Insert the POSITIONING SPRINGS and the CLUSTER PLATE ASSEMBLY over the TIE RODS and engage the BUSHINGS with the JET ORIFICES.
9. Insert the BUSHINGS and the PRELOAD SPRINGS over the TIE RODS.
10. Slide the TIE ROD HOLDERS over the TIE RODS.

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11. Align the flats on the TIE ROD HOLDERS with the slots in the POSITIONING PLATE and compress the PRELOAD SPRINGS with the POSITIONING PLATE by turning the HANDLE counter-clockwise until the cluster length (the distance from the shoulder of the TIE ROD HOLDERS to the bottom of the SUPPORT) equals $57.505 \pm .010$ inches.
12. Thread the TIE ROD NUTS onto the TIE RODS and at the same time prevent the TIE RODS from turning.
13. Insert the LOCK PINS through the TIE RODS and the TIE ROD NUTS. Retract the POSITIONING PLATE all the way by turning the HANDLE clockwise.
14. Remove the BACK-UP PLATE. Carefully remove the CLUSTER ASSEMBLY from the ASSEMBLY FIXTURE and place on the table.
    Verify that the cluster length dimension does not exceed $57.515 \pm .010$ inches.
15. Carefully hand-carry the finished CLUSTER ASSEMBLY from the Table to the CORE ASSEMBLY or STORAGE area.

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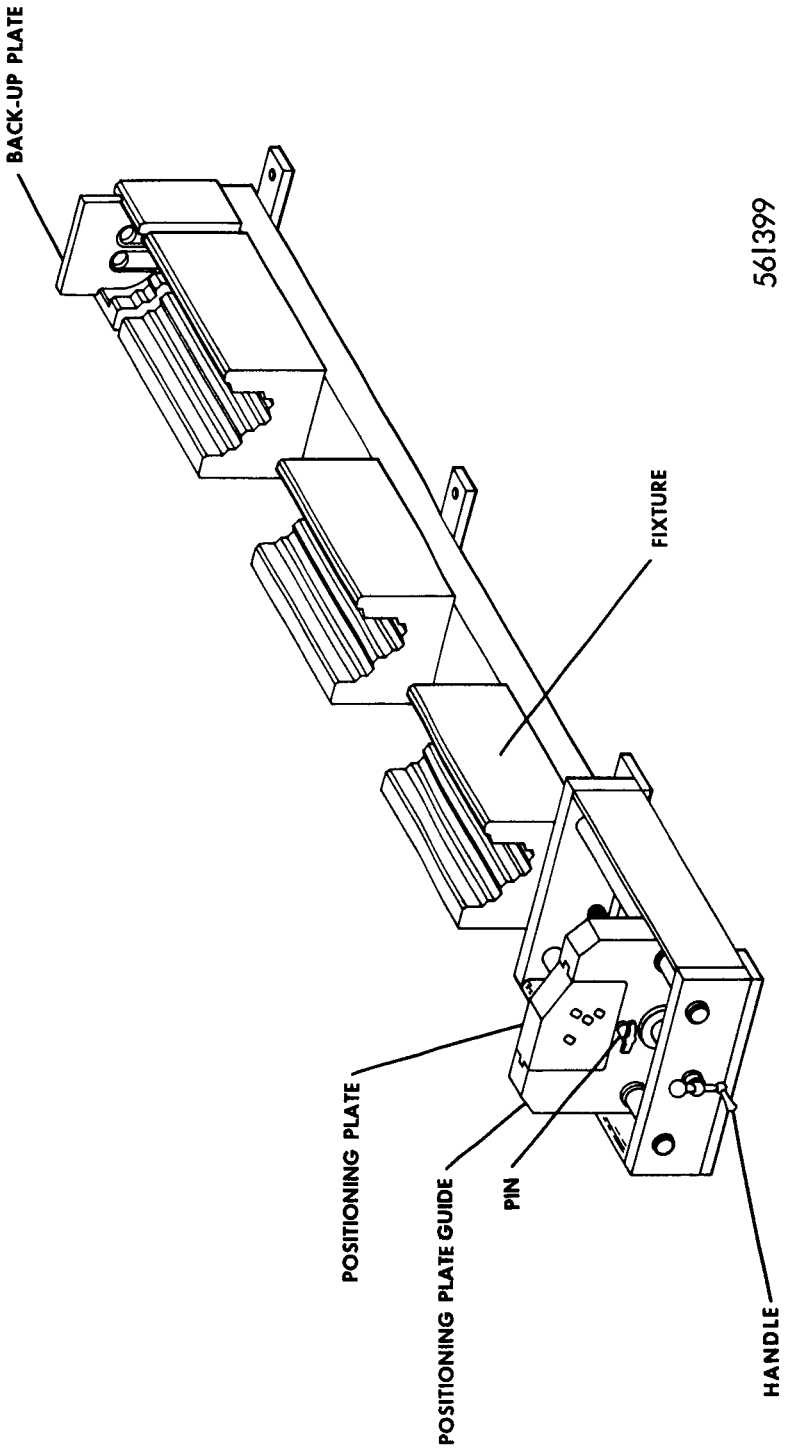

Figure 6 - 1 Assembly Fixture Tool No. ND 600014

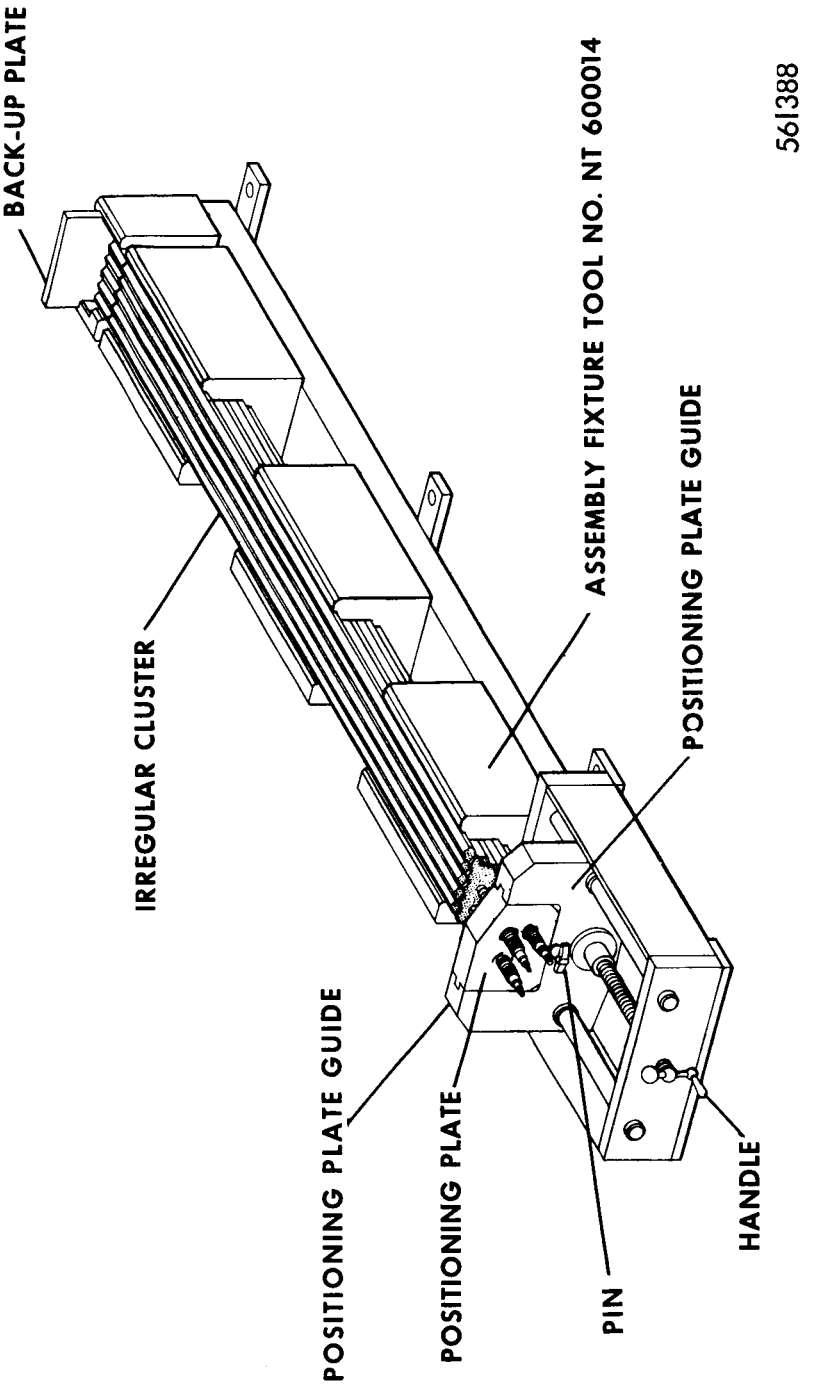

Figure 6 - 2 Assembly of the Irregular Fuel Cluster

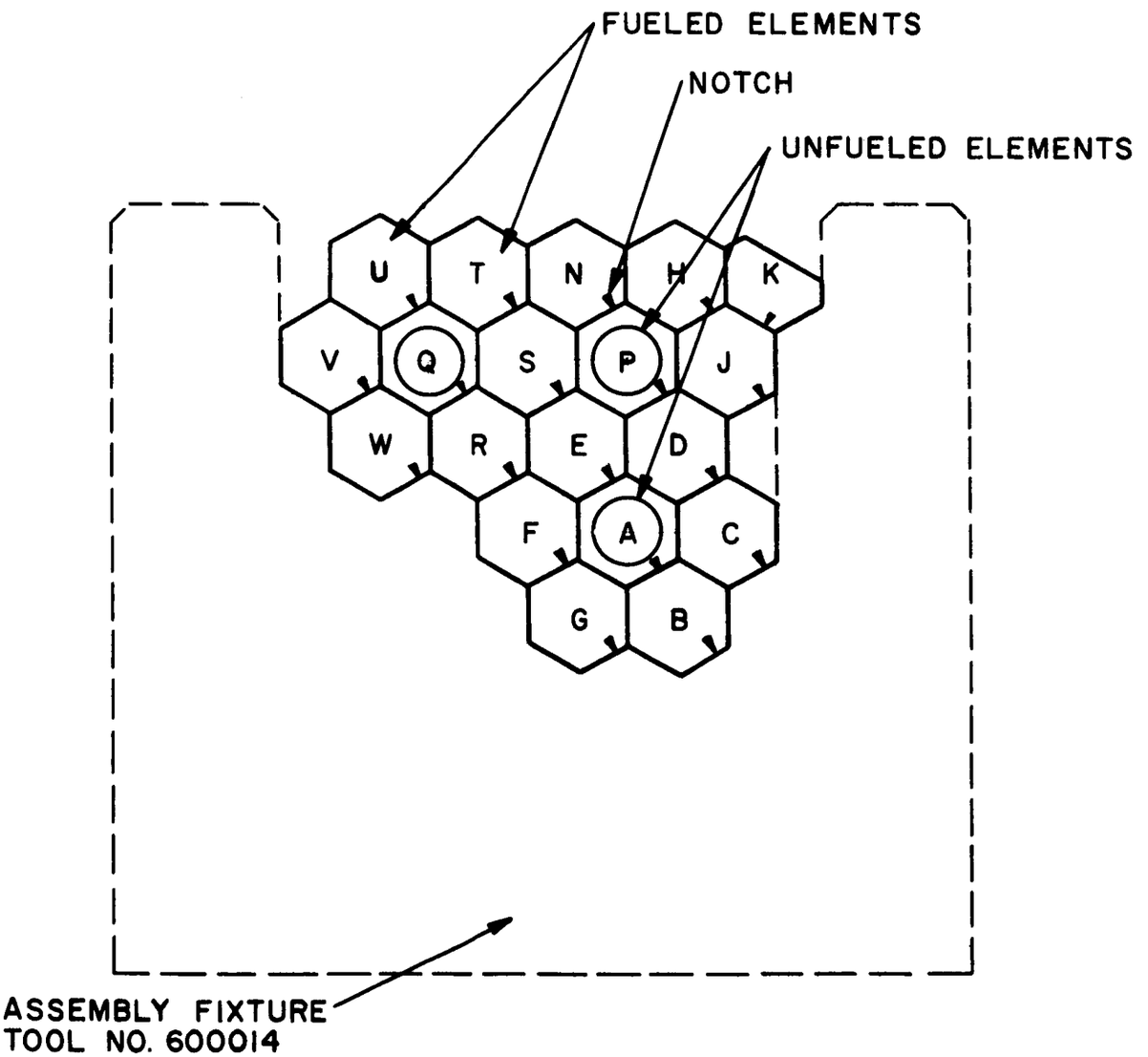

Figure 6 - 3 Dome End View Irregular Cluster J-3 Showing Element Location and Orientation

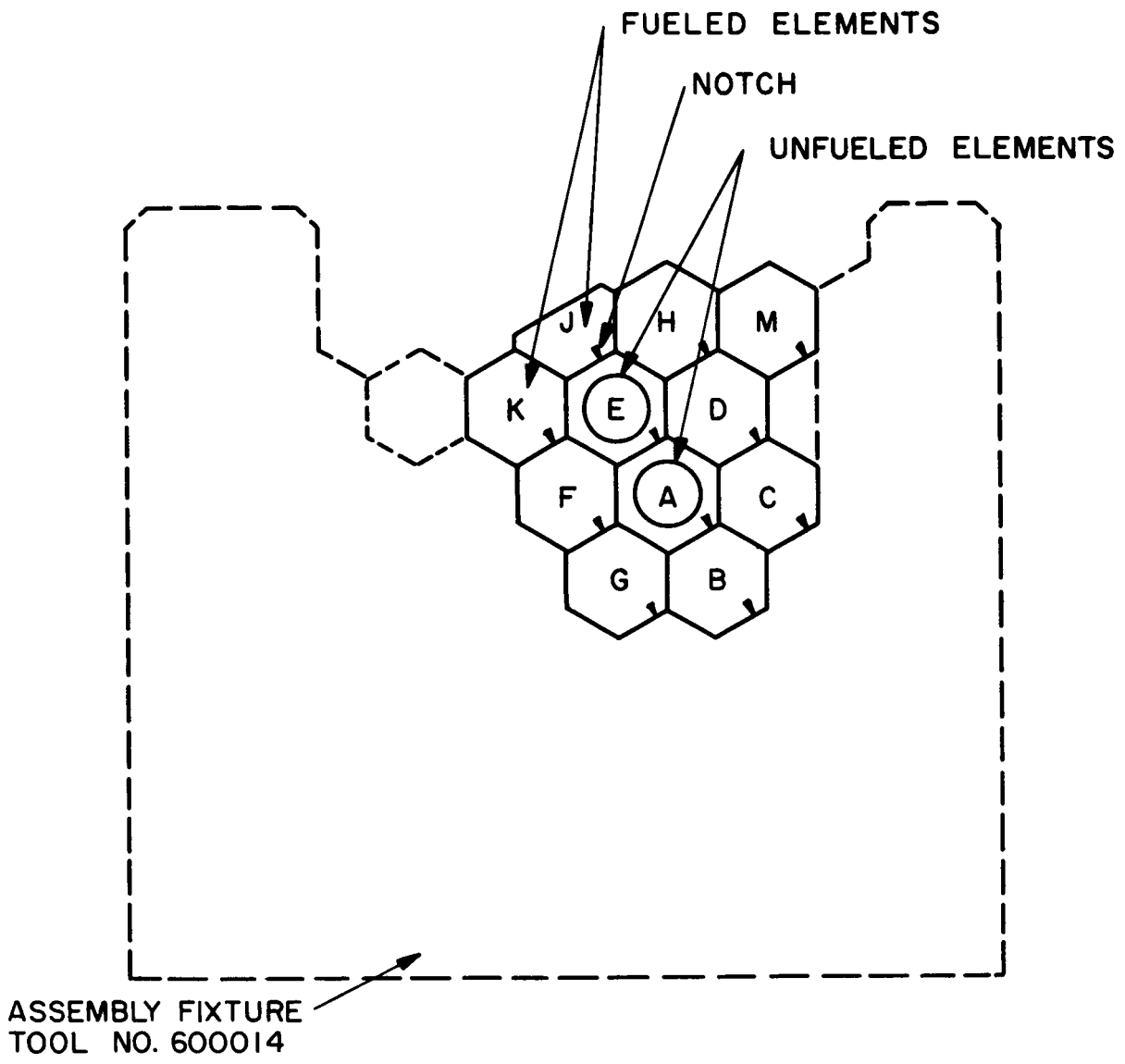

Figure 6 - 4 Dome End View Irregular Cluster J-4 Showing Element Location and Orientation

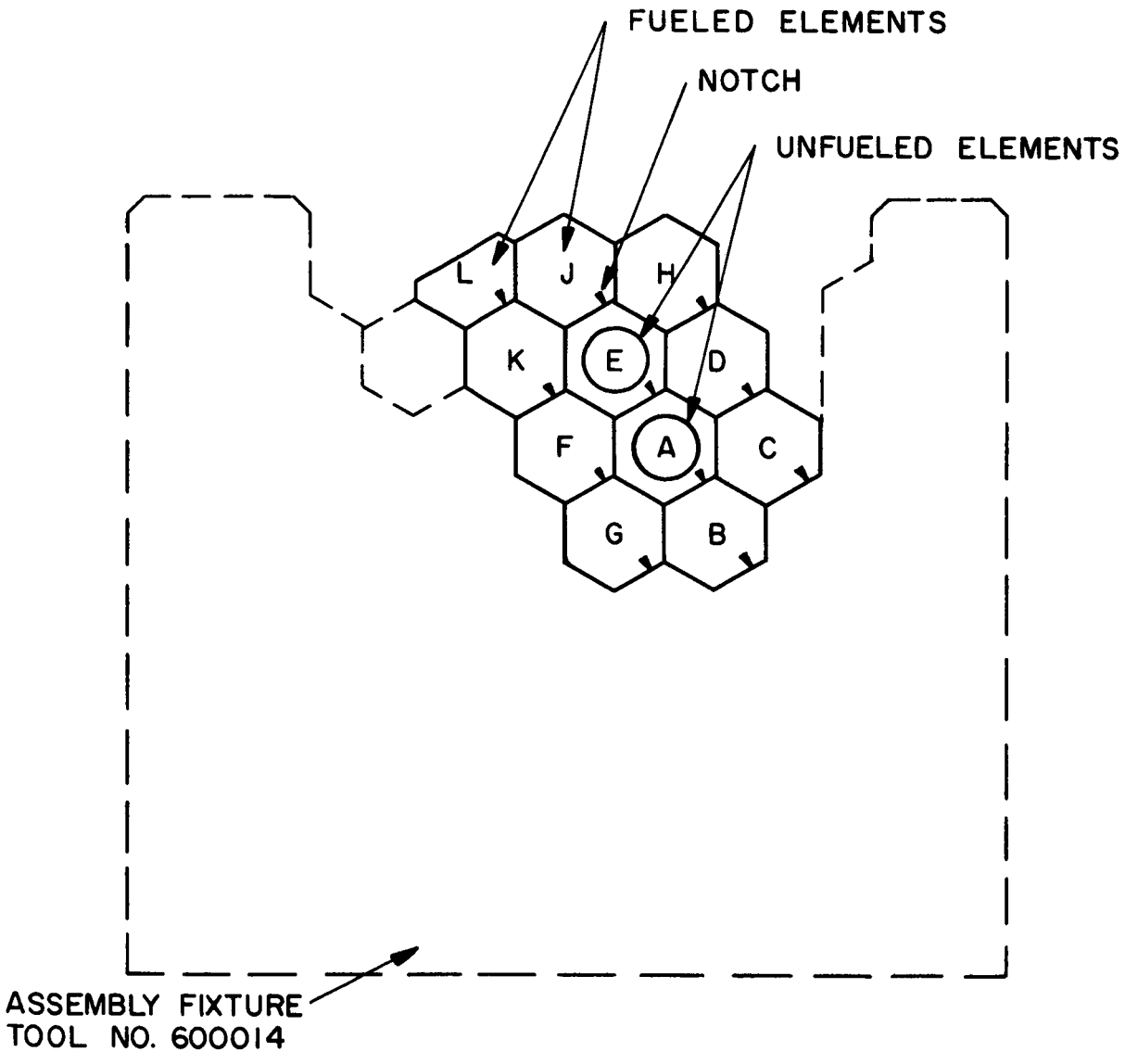

Figure 6 - 5 Dome End View Irregular Cluster J-5 Showing Element Location and Orientation

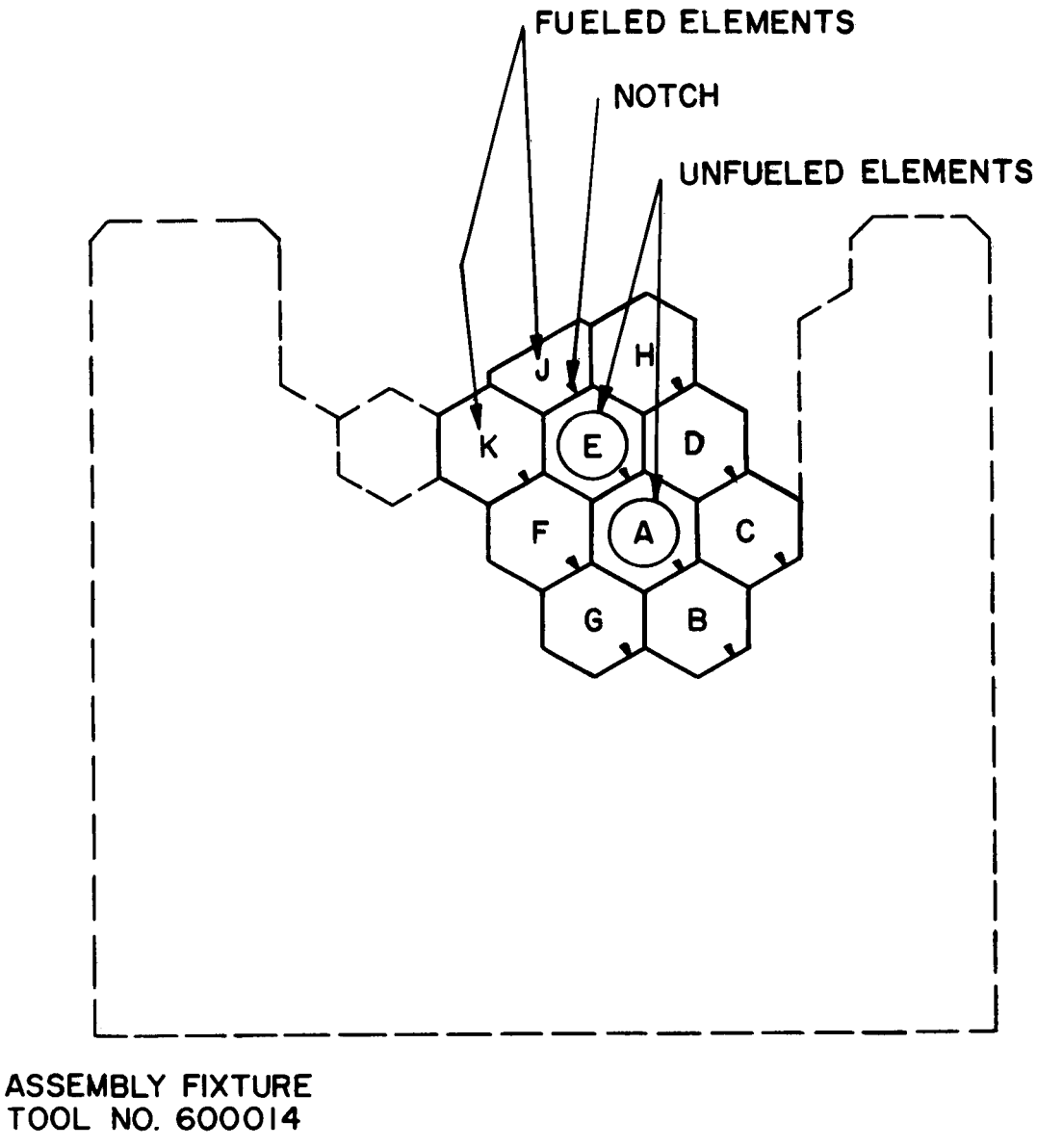

Figure 6 - 6 Dome End View Irregular Cluster J-6 Showing Element Location and Orientation

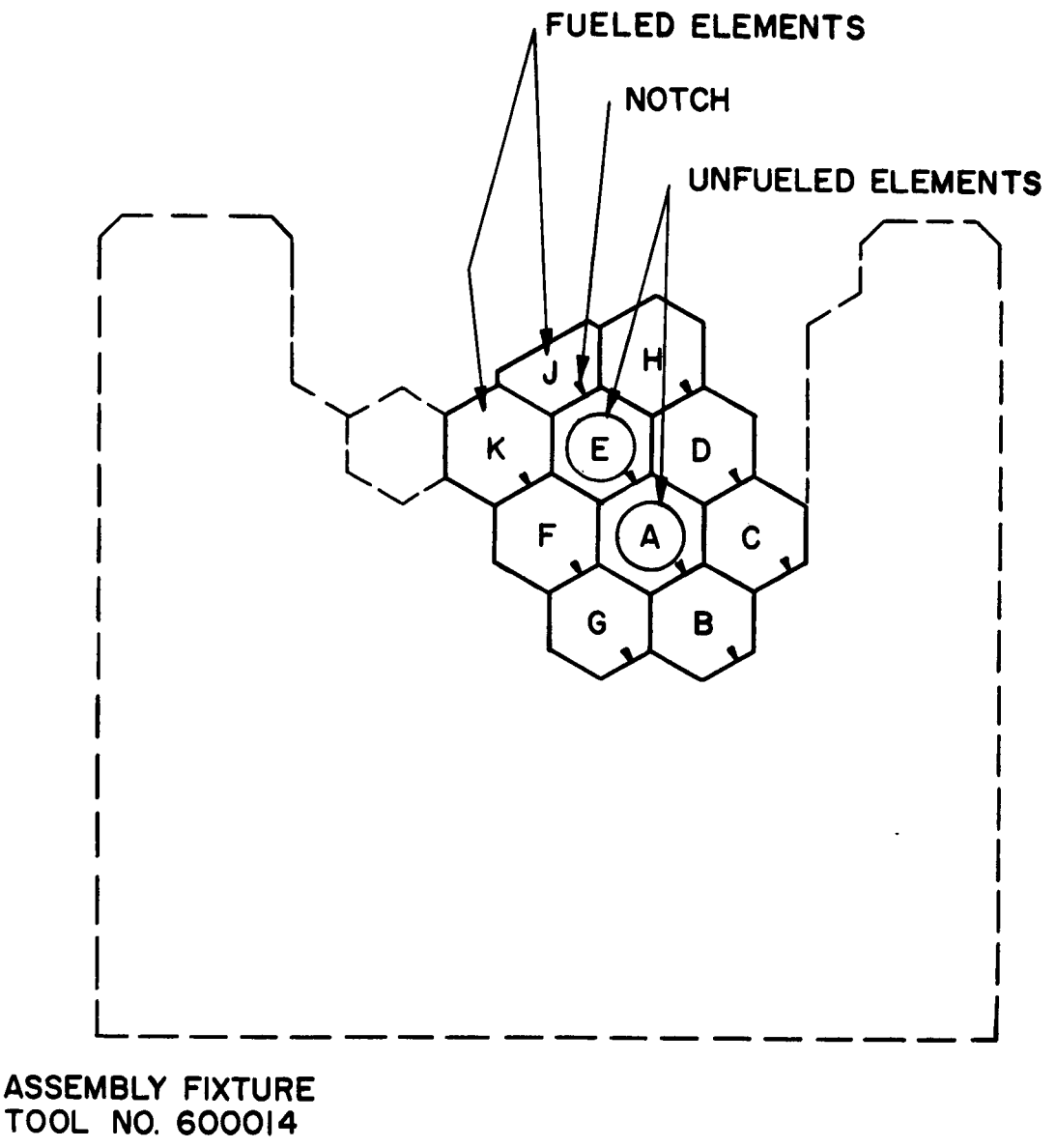

Figure 6 - 7 Dome End View Irregular Cluster J-7 Showing Element Location and Orientation

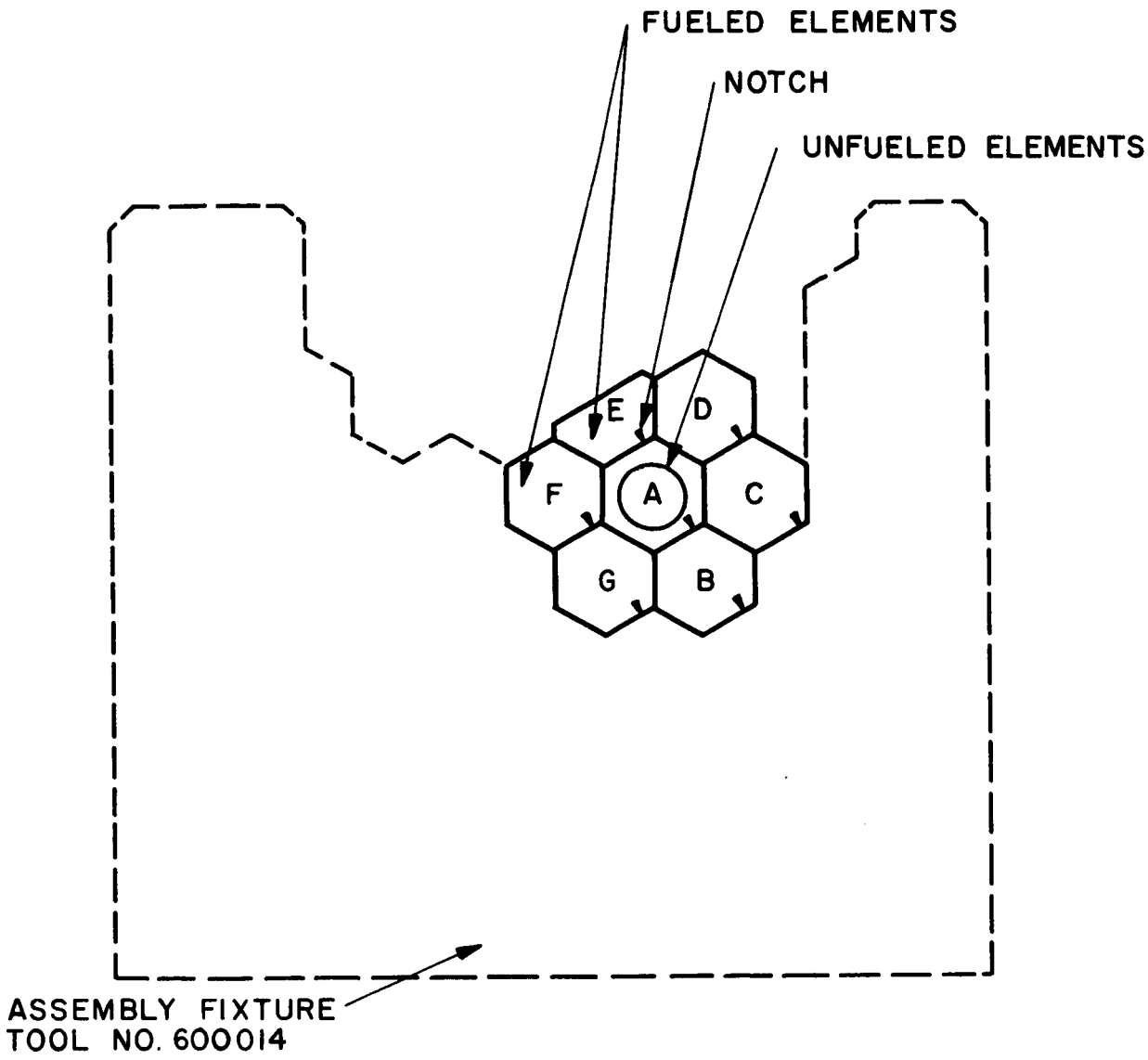

Figure 6 - 8 Dome End View Irregular Cluster J-8 Showing Element Location and Orientation

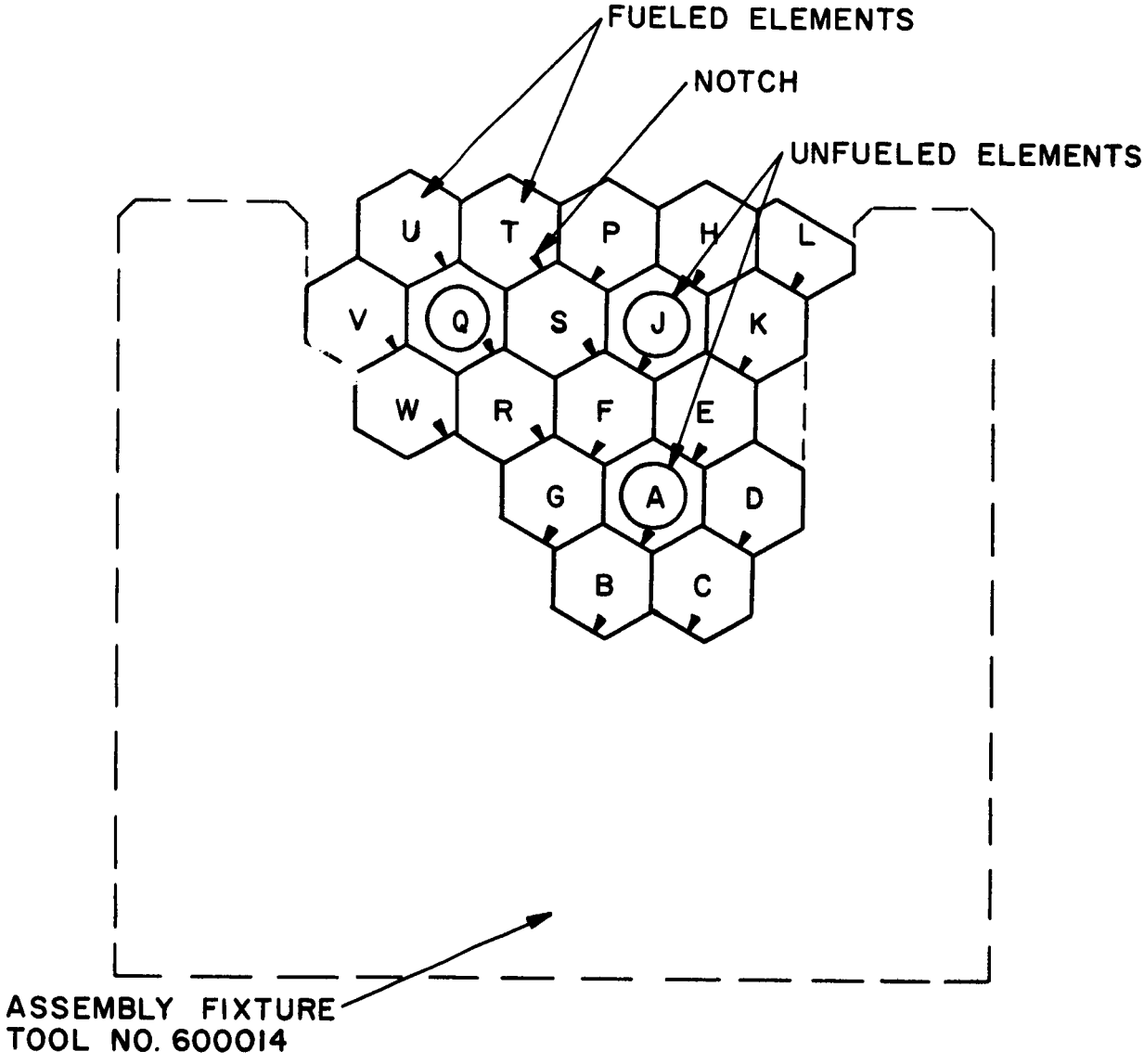

Figure 6 - 9 Dome End View Irregular Cluster J-9 Showing Element Location and Orientation

SECTION VII

ASSEMBLY OF THE CORE

THE ASSEMBLY STAND MUST BE PERMANENTLY CONNECTED TO THE GROUND.

WARNING

OBSERVE THE HEALTH AND SAFETY PRECAUTIONS FOR HANDLING RADIO-ACTIVE MATERIAL AS OUTLINED IN THE CRITICALITY HAZARDS CONTROL GUIDE, WANL-TME-185. IN ADDITION, THE REACTOR ASSEMBLY AREA CRITICALITY HAZARDS CONTROL PROCEDURES, RA-048 MUST BE OBSERVED.

ELECTRICAL OPERATION OF THE ASSEMBLY STAND:

Refer to Figure Nos. 7-1 and 7-2.

The CLUSTER TEMPLATE can be traversed to a minimum height or maximum height as follows:

MINIMUM HEIGHT:

1. Remove the ASSEMBLY STOP and the SAFETY STOP.

2. Turn MOTOR STARTER DOOR HANDLE to the "ON" position.
3. Hold the PORTABLE SWITCH in the "DOWN" position to lower the TEMPLATE. Releasing the PORTABLE SWITCH will stop the TEMPLATE CARRIER.

NOTE

LIMIT SWITCH NO. 3 (LS-3) WILL STOP THE CLUSTER TEMPLATE 4.25 INCH ABOVE THE SUPPORT PLATE ASSEMBLY.

MAXIMUM HEIGHT:

CAUTION

WHEN MOVING THE TEMPLATE CARRIER FROM MINIMUM HEIGHT TO MAXIMUM HEIGHT, MAKE SURE THAT THE SAFETY STOP IS REMOVED.

1. Hold the PORTABLE SWITCH in the "UP" position.
2. Limit SWITCH NO. 1 (LS-1) will stop the TEMPLATE CARRIER at its maximum height.

WORKING HEIGHT:

1. Install ASSEMBLY STOP and insert SAFETY STOP in the COLUMN.
2. Hold PORTABLE SWITCH in "DOWN" position.
3. Limit SWITCH NO. 2 (LS-2) will be engaged by the ASSEMBLY STOP to position the CLUSTER TEMPLATE at the WORKING

HEIGHT of 60.180 inches above the SUPPORT PLATE ASSEMBLY.

4. Disconnect power to the ASSEMBLY STAND by turning MOTOR STARTER DOOR HANDLE to the "OFF" position.

PREPARATION AND HANDLING:

Prepare the ASSEMBLY STAND, Tool No. NT 600004, for assembly of the core as follows:

Refer to Figure No. 7-3.

1. Remove the CLUSTER TEMPLATE from the TEMPLATE CARRIER.
2. Level the top surface of the FIXTURE in two perpendicular directions using the LEVELING JACKS and spanner wrench to obtain necessary adjustment.
3. Install the CORE FIXTURE PLATFORMS. Apply a tightening torque of 350 inch lbs. to the twelve bolts.
4. Align the three INNER REFLECTOR GUIDES with the LIFTING FIXTURE, Tool No. NT 600011. Apply a tightening torque of 300 inch lbs. to the twelve bolts.
5. Assemble the INSTRUMENTATION RING and the LOCKING DEVICES per Reactor Assembly Process Outline, RAPO No. 3001, titled "INSTRUMENTATION RING ASSEMBLY".
6. Position the INSTRUMENTATION RING ASSEMBLY and the PINS on the ledge beneath the FIXTURE.
7. Assemble the SUPPORT PLATE, the DOME END SEAL and the LOCATING PIN per to Reactor Assembly Process Outline, RAPO No. 1072 titled "SUPPORT PLATE ASSEMBLY".

8. Place the SUPPORT PLATE ASSEMBLY on the FIXTURE, using the LIFTING FIXTURE, Tool No. NT 600023, the LIFTING FIXTURE YOKE, Tool No. NT 600070 and the overhead crane. See Figure Nos. 7-4 and 7-5.

Align the $\theta = 0$ reference marks on the SUPPORT PLATE ASSEMBLY and the FIXTURE and insert the two CORE SUPPORT PLATE LOCATING PINS in the holes in the SUPPORT PLATE. Hand tighten the two LOCATING PIN SCREWS.

9. Remove the LIFTING FIXTURE, Tool No. NT 600023 and the LIFTING FIXTURE YOKE, Tool No. NT 600070.
10. Replace the CLUSTER TEMPLATE in the TEMPLATE CARRIER using a cable sling and the overhead crane. Hand tighten the eight bolts.
11. Remove the ASSEMBLY STOP and the SAFETY STOP and lower the CLUSTER TEMPLATE to its minimum height (4.25 inch above the FIXTURE).
12. Align the CLUSTER TEMPLATE holes with the Tie Rod holes in the SUPPORT PLATE ASSEMBLY by engaging the two TEMPLATE LOCATING PINS with the same holes in the SUPPORT PLATE ASSEMBLY where the CORE SUPPORT PLATE LOCATING PINS have been placed (see paragraph 7 above).

    Apply maximum tightening torque of 300 inch lbs. to the eight bolts.
13. Raise the TEMPLATE CARRIER to its highest point, install the ASSEMBLY STOP and the SAFETY STOP and remove the two TEMPLATE LOCATING PINS.

ASSEMBLY:

For location of parts refer to Figure Nos. 7-6 and 7-7.

1. Orient and insert the CENTRAL FUEL CLUSTER into the SUPPORT

PLATE ASSEMBLY as shown on Figure No. 7-8.

CAUTION

CLUSTERS ARE MADE FROM BRITTLE MATERIAL. HANDLE WITH CARE.

2. Lower the TEMPLATE with a CLUSTER LOCATING PIN in the center hole to its working height over the CENTRAL CLUSTER.

CAUTION

MAKE SURE THE CLUSTER LOCATING PIN ENGAGES THE HEAD OF THE TIE ROD AS SHOWN ON FIGURE NO. 7-7

3. Attach the six POSITIONING POSTS (corner clusters) and fix the vertical position of the CENTRAL CLUSTER as established by the SUPPORT PLATE ASSEMBLY and the CLUSTER LOCATING PIN through the six POSITIONING POSTS (corner clusters). See Figure No. 7-7. Fasten the TIE ROD HOLDER underneath the STAND with the LOCKING DEVICE and the NUT. See Figure No. 7-9.
4. Remove the CLUSTER LOCATING PIN and raise the TEMPLATE CARRIER to its maximum height.
5. Withdraw one POSITIONING POST (corner clusters) and assemble the first CLUSTER of the first row against the CENTRAL CLUSTER and position with the POSITIONING POST (corner clusters). Proceed

in the same manner as above with the assembly of the remaining CLUSTERS of the first row, in sequence and orientation of the NOTCH in the CLUSTER PLATES as shown in Figure No. 7-8.

6. Lower the TEMPLATE with six CLUSTER LOCATING PINS in each of the holes corresponding to the CLUSTER centers of the 1st row.

CAUTION

MAKE SURE THE CLUSTER LOCATING PINS ENGAGE THE HEADS OF THE TIE RODS AS SHOWN ON FIGURE NO. 7-7.

Fasten each TIE ROD HOLDER underneath the STAND with a LOCKING DEVICE and the NUT. Refer to Figure No. 7-9.

7. Remove the CLUSTER LOCATING PINS and raise the TEMPLATE to its maximum height.

8. Withdraw a POSITIONING POST (corner clusters) and assemble the first CLUSTER of the 2nd row against the CLUSTERS of the 1st row and position with a POSITIONING POST (corner clusters). Assemble the second CLUSTER of the 2nd row and position with a POSITIONING POST. Withdraw a POSITIONING POST (corner clusters) and assemble the third CLUSTER of the 2nd row and position with a POSITIONING POST (corner clusters). Proceed with the assembly of the remaining CLUSTERS of the 2nd row as outlined above in sequence and orientation of the NOTCH in the CLUSTER PLATES as shown in Figure No. 7-10.

9. Repeat Step (6) and (7) above except that the CLUSTER LOCATING PINS must correspond to the CLUSTER centers of the 2nd row.

10. Proceed with the assembly of the subsequent rows of clusters as follows:

Withdraw or remove a POSITIONING POST and in its place assemble and position a CLUSTER. Position CLUSTERS placed against CLUSTERS held previously by a POSITIONING POST (corner clusters) with the same POSITIONING POST (corner clusters) position all other CLUSTERS with a POSITIONING POST. The sequence and orientation of the NOTCH of the CLUSTER PLATES for the subsequent rows is shown in the following Figures:

3rd row of CLUSTERS see Figure No. 7-11
4th row of CLUSTERS see Figure No. 7-12
5th row of CLUSTERS see Figure No. 7-13
6th row of CLUSTERS see Figure No. 7-14
7th row of CLUSTERS see Figure No. 7-15

After each row is assembled and positioned repeat steps (6) and (7) above except that in each instance, the CLUSTER LOCATING PINS must correspond to the cluster centers of the respective row.

11. Remove the POSITIONING POST holding the 6-G7 CLUSTER, assemble the 6-H7 CLUSTER and position with a POSITIONING POST. Proceed with assembly of the remaining CLUSTERS of the 8th row in sequence and orientation of the NOTCH in the CLUSTER PLATE as shown in Figure No. 7-16. Position CLUSTER H6 H5 with a POSITIONING POST and CLUSTERS H4 and H3 with a POSITIONING BRACKET as

shown in Figure No. 7-16. Lower the TEMPLATE with eighteen CLUSTER "LOCATING PINS" corresponding to the cluster centers of the H7, H6 and H5 CLUSTERS. Repeat step (6) and (7) above.

12. Withdraw the POSITIONING POST holding 6-H7 CLUSTER and assemble the 6-J7 CLUSTER against the CLUSTERS of the 8th roq and position with the POSITIONING POST (IRREGULAR CLUSTERS). Proceed with the assembly of the 6-J6 and 6-J5 CLUSTERS. Repeat the above procedure for all J7, J6 and J5 CLUSTERS in sequence as shown on Figure No. 7-17. Withdraw the POSITIONING POST (corner clusters) holding the 1-G1 CLUSTER and remove the POSITIONING POSTS holding the 1-H4, assemble the 6-J8, 6-J9, 1-J3 and 1-J4 CLUSTERS as a group and position the 6-J8 CLUSTER with the POSITIONING POST (IRREGULAR CLUSTERS) and the 6-J9 CLUSTER with the POSITIONING POST (corner clusters). Proceed with the assembly of the remaining CLUSTERS of the 9th row as outlined above.

13. Repeat steps (6) and (7) except the number and position of the CLUSTER LOCATING PINS must correspond to the CLUSTER CENTERS of the 9th row.

14. Remove the CLUSTER TEMPLATE from the TEMPLATE CARRIER using the overhead crane and a sling.

15. Withdraw the POSITIONING POSTS (IRREGULAR CLUSTERS) one by one and assemble against the CLUSTERS of the 9th row the six sets of the FIXTURE GAUGES, Tool Nos. NT 600170 to NT 600180 as shown on Figure Nos. 7 - 18 and 7 - 19. Replace the ends of the POSITIONING POSTS (corner clusters) with core POSITIONING shoes and use to position the FIXTURE GAUGES.

16. Bundle the CORE with STRAPS as shown in Figure No. 1-19.

17. Assemble the BUNDLING FIXTURE, Tool No. NT 600182 around the CORE by positioning a BUNDLING FIXTURE RING between the STRAPS and one on each end of the CORE. See Figure Nos. 7-20 and 7-21.

18. Inflate the BUNDLING FIXTURE to 3.8 PSIG.

19. Remove all POSITIONING POST (corner clusters) and all POSITIONING POSTS (IRREGULAR CLUSTERS) and the STRAPS.

20. Using the overhead crane and a sling, install the MEASURING FIXTURE, Tool No. NT 600183 as shown on Figure No. 7-22.

21. Adjust to zero all the INDICATORS on the INDICATOR BAR and install in the MEASURING FIXTURE as shown in Figure No. 7-22.

22. Proceed with the measuring of each FILLER STRIP and record the results.

23. After all FILLER STRIPS have been measured, remove the MEASURING FIXTURE.

24. Replace the FIXTURE GAUGES with the FILLER STRIP assemblies as shown on Figure No. 7-23.

25. Replace the straps, deflate and remove the BUNDLING FIXTURES.

26. Install the FILLER STRIP RETAINING FIXTURE, Tool No. NT 600147 and the CORE ASSEMBLY COVER, Tool No. NT 600017 and install the POSITIONING POSTS (corner clusters) equipped with CORE POSITIONING SHOES as shown on Figure No. 7-24.

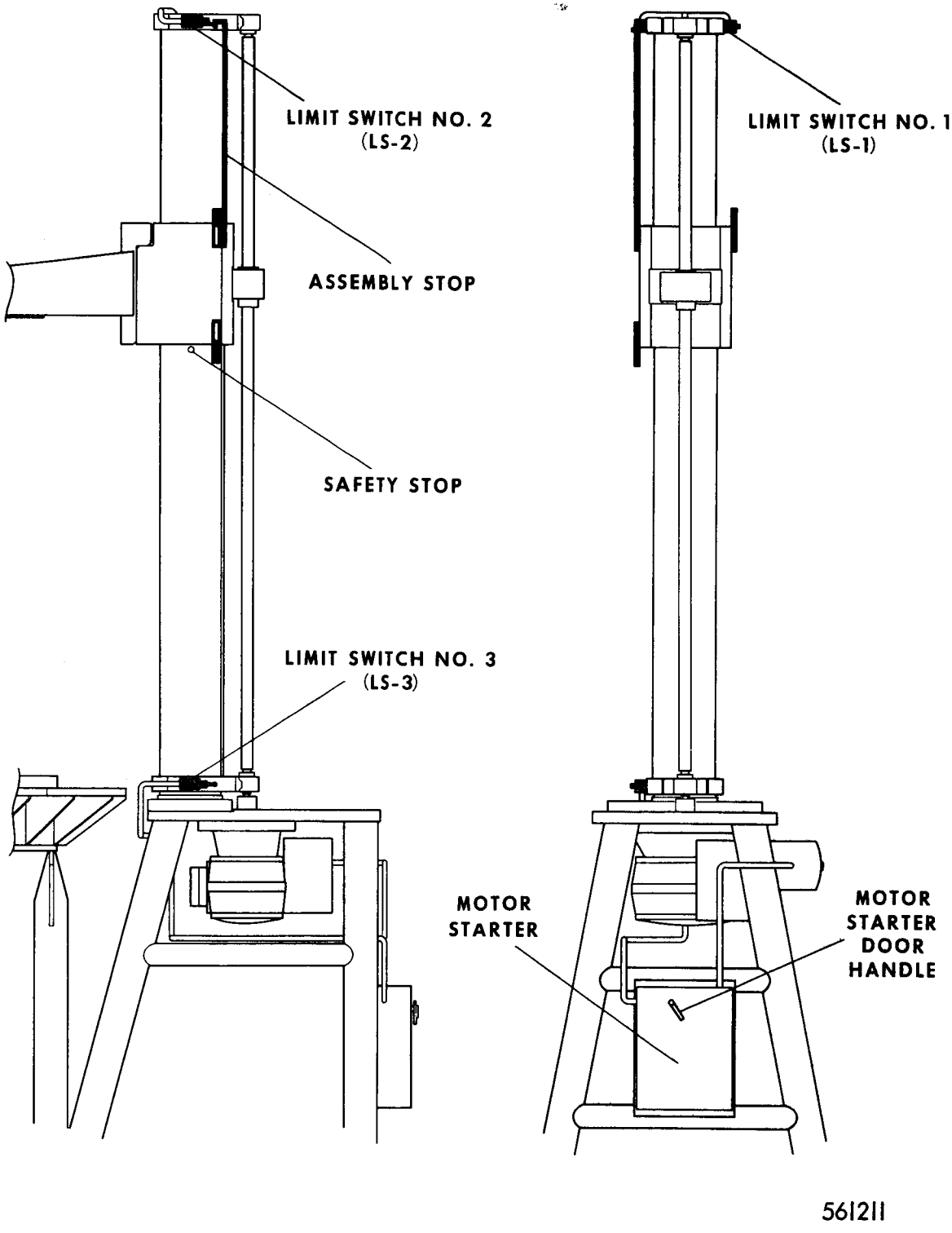

Figure 7 - 1 Controls for Assembly Stand Tool No. NT 600004

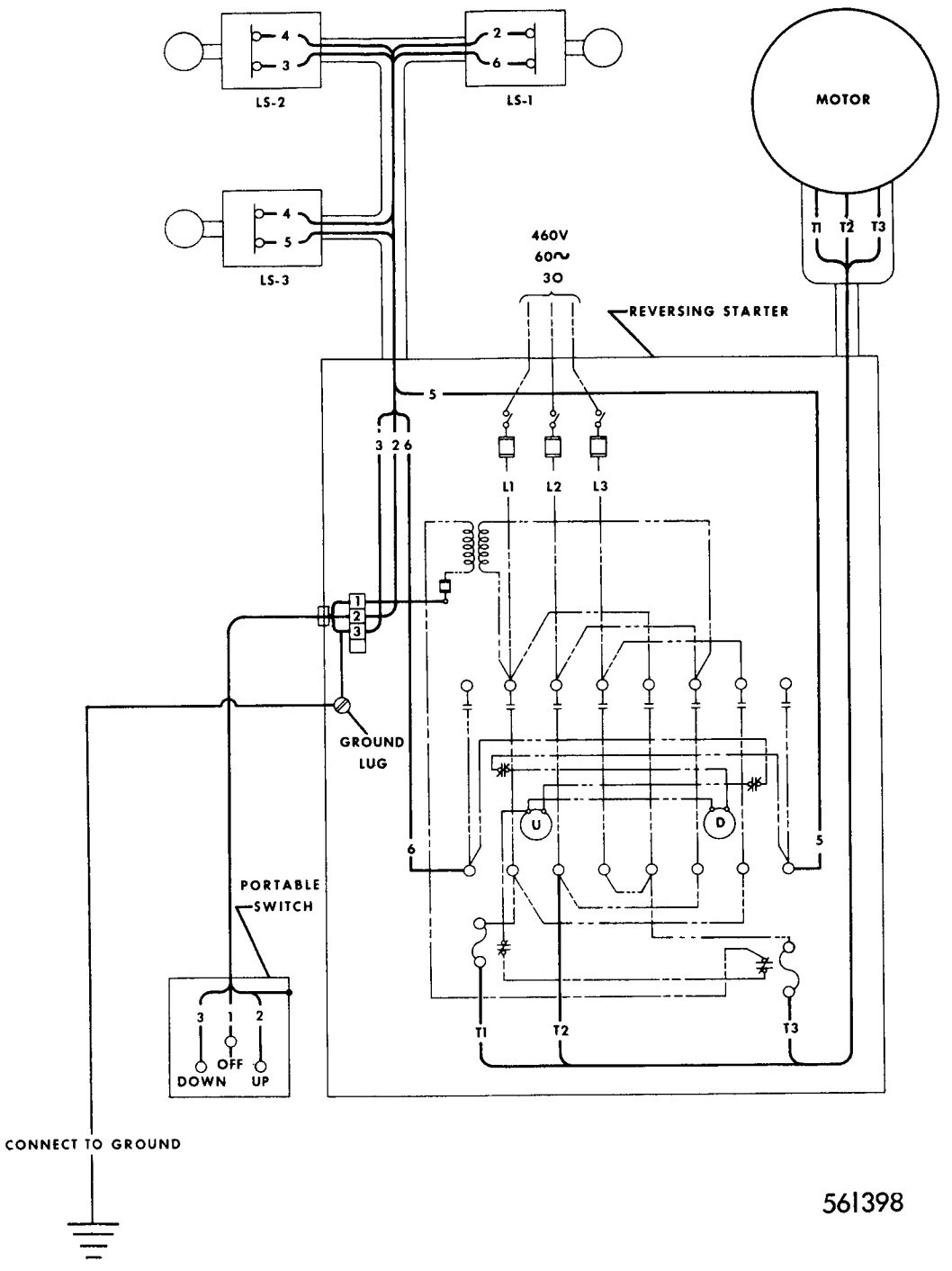

Figure 7 - 2 Wiring Diagram for Assembly Stand Tool No. NT 600004

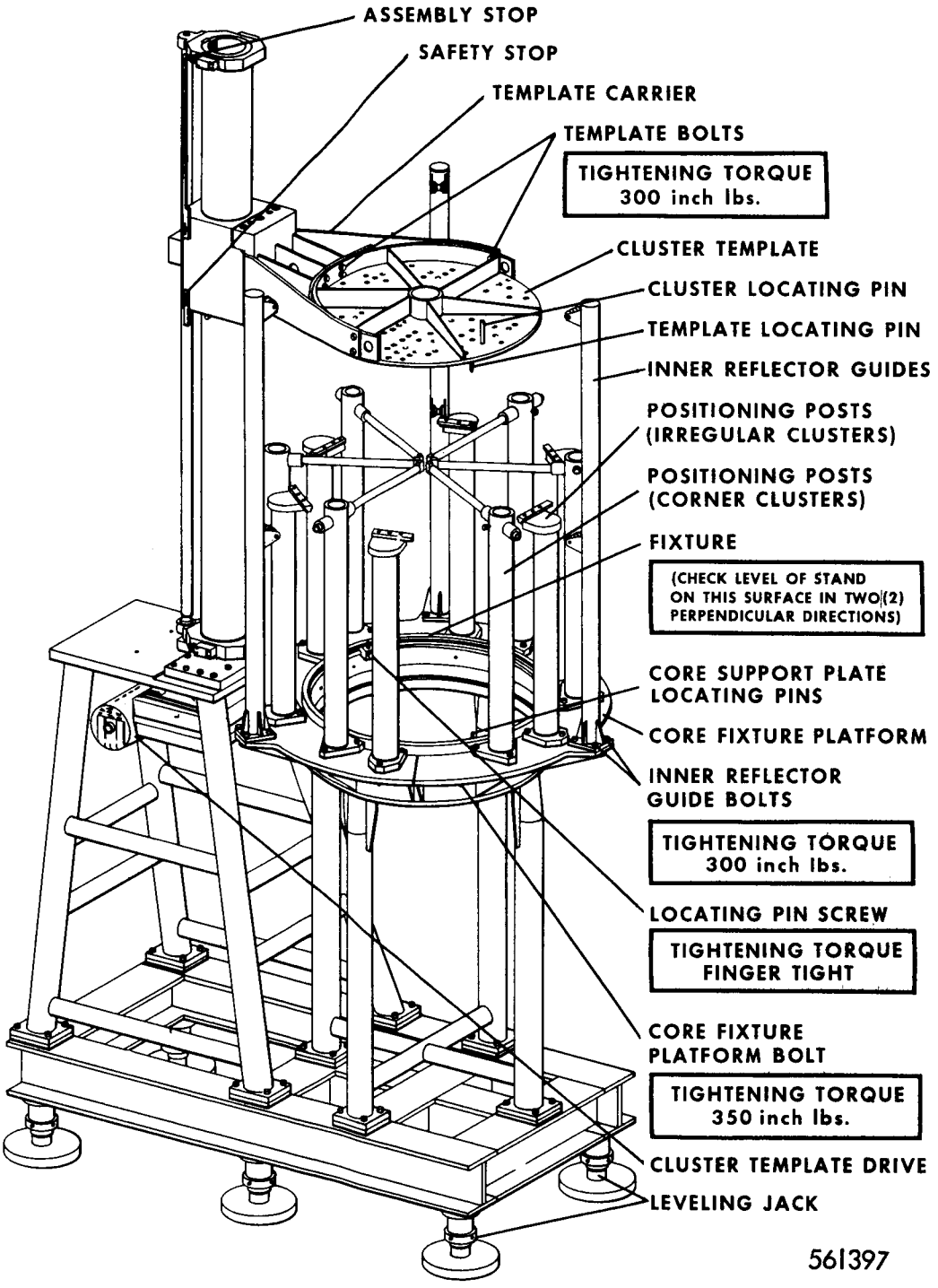

Figure 7 - 3 Assembly Stand Tool No. NT 600004

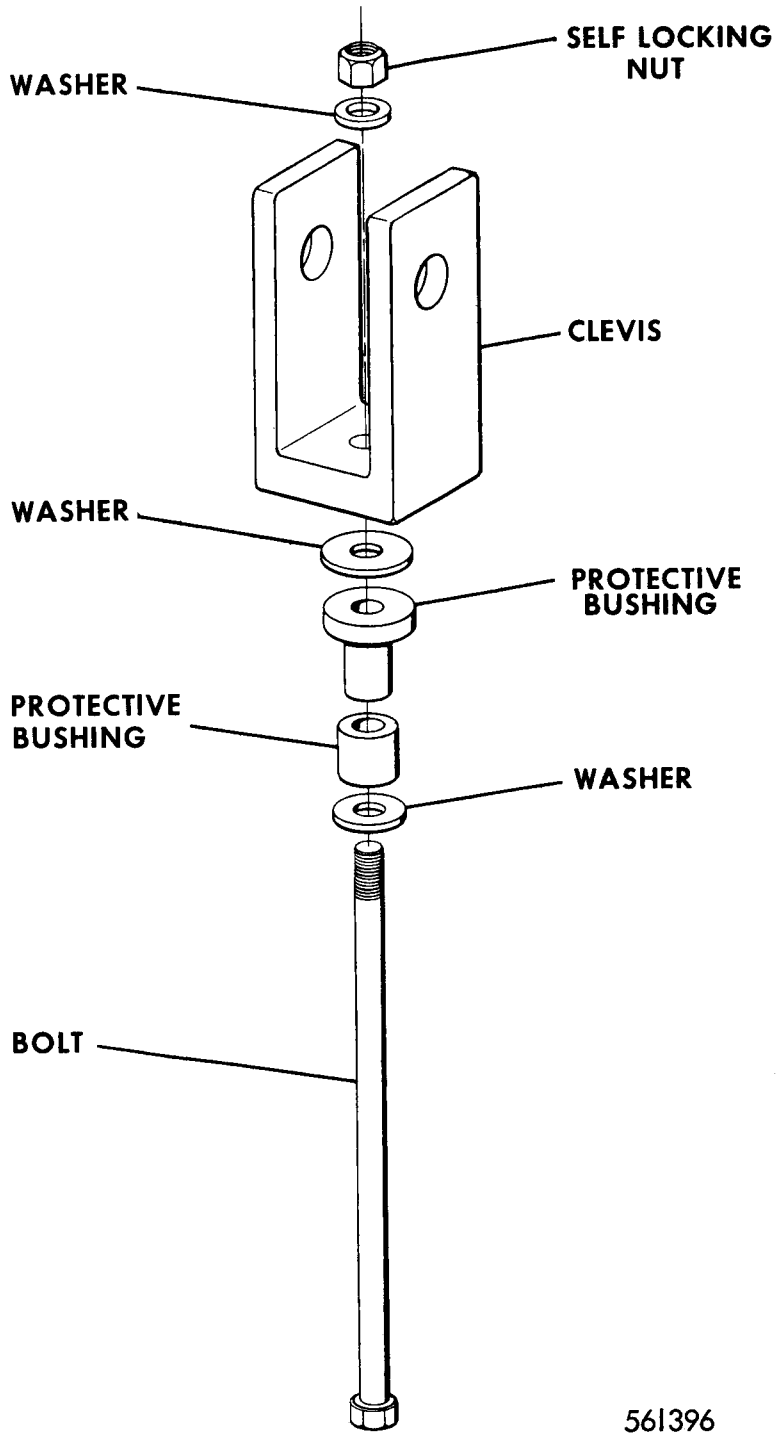

Figure 7 - 4 Lifting Fixture Tool No. NT 600023

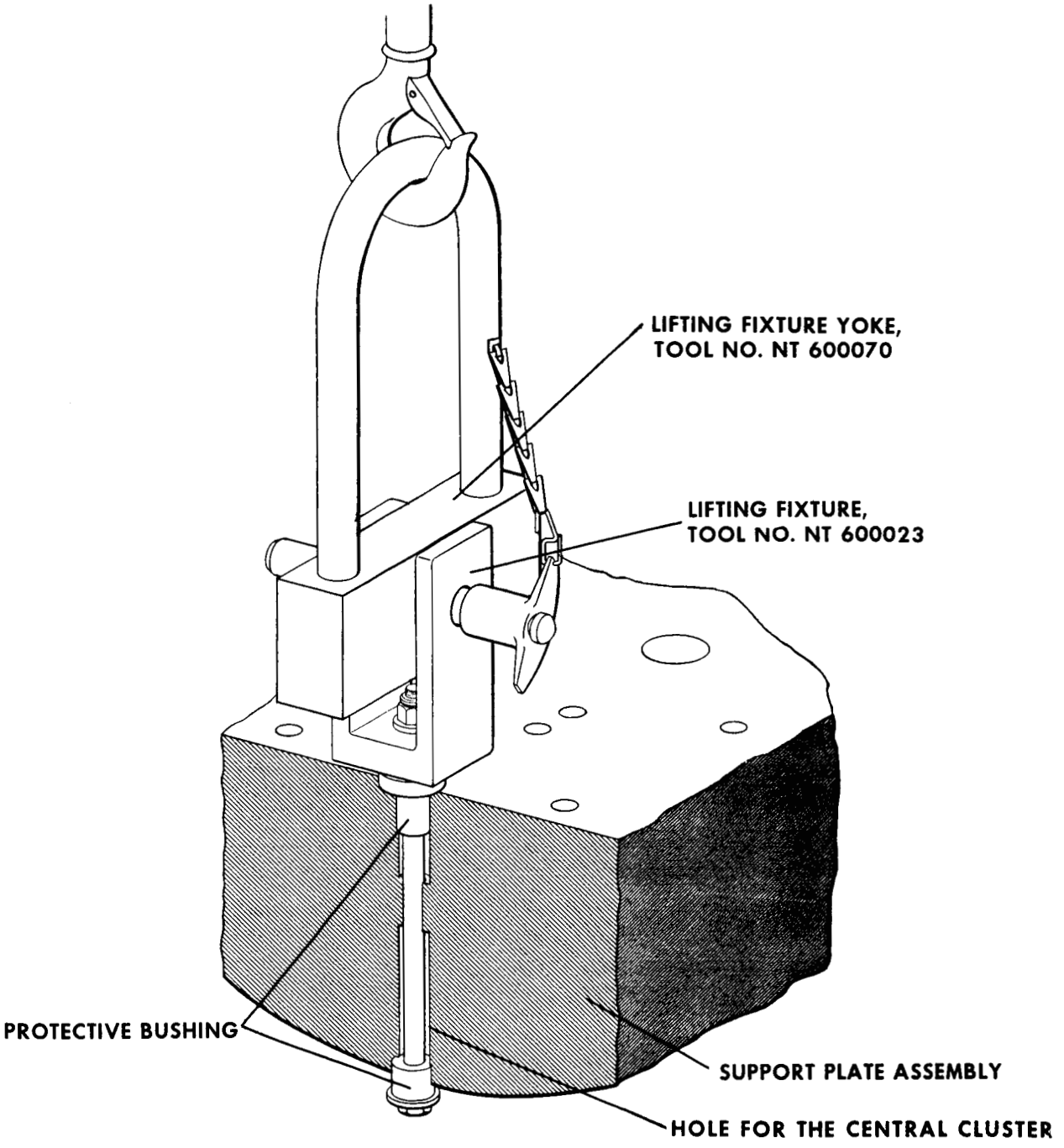

Figure 7 - 5 Handling of Support Plate Assembly

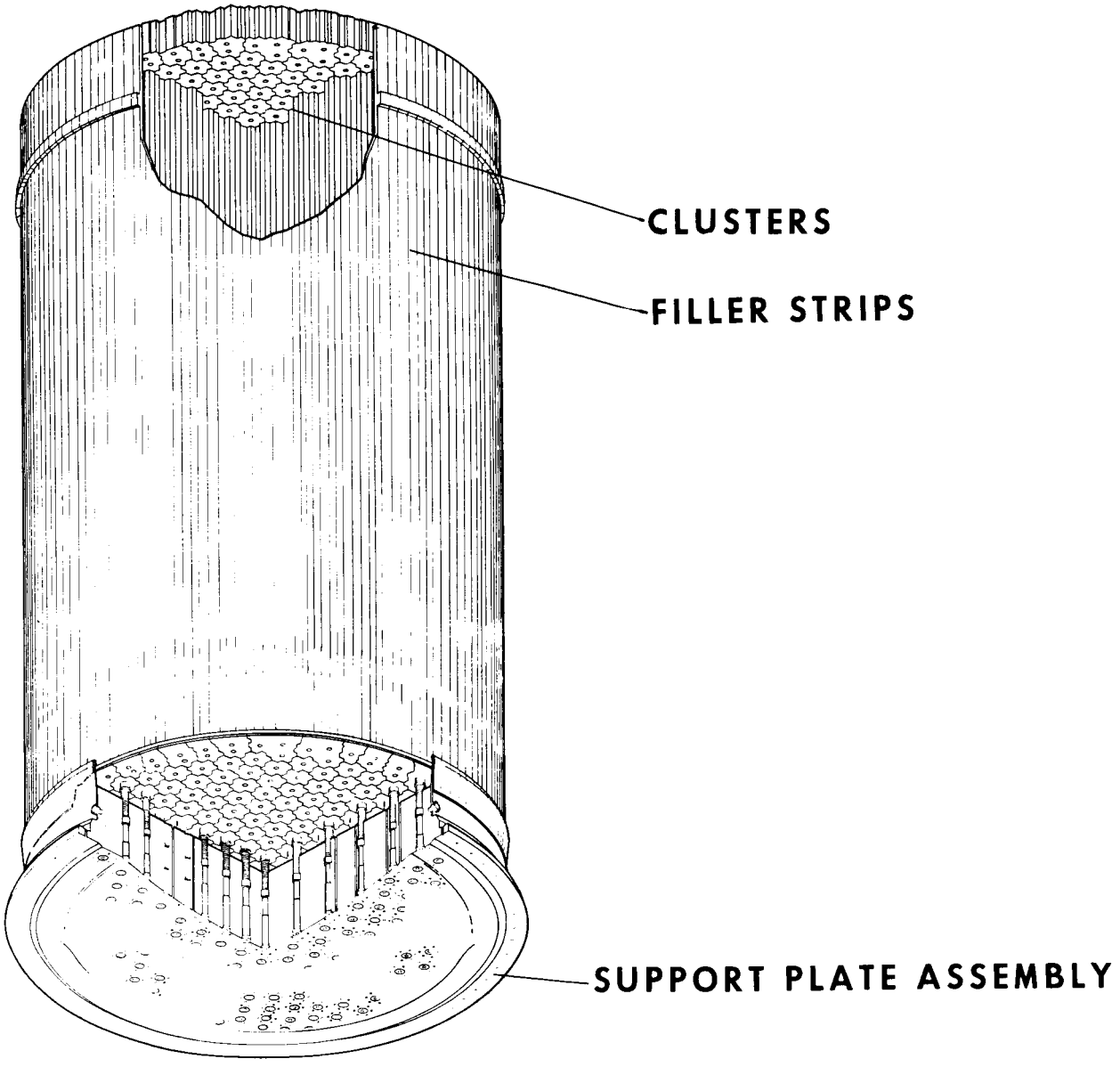

Figure 7 - 6 Core Assembly

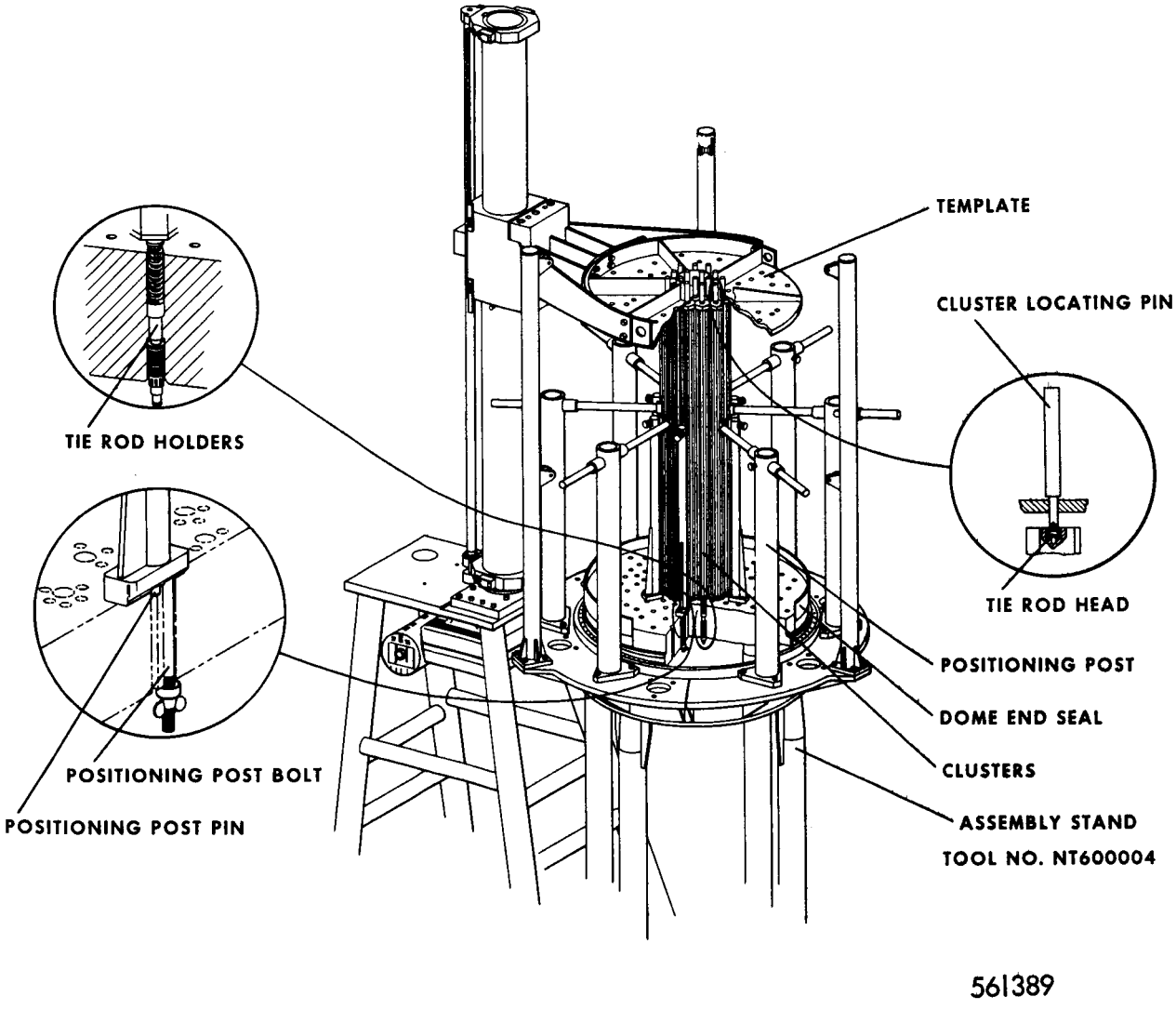

Figure 7 - 7 Assembly of the Core

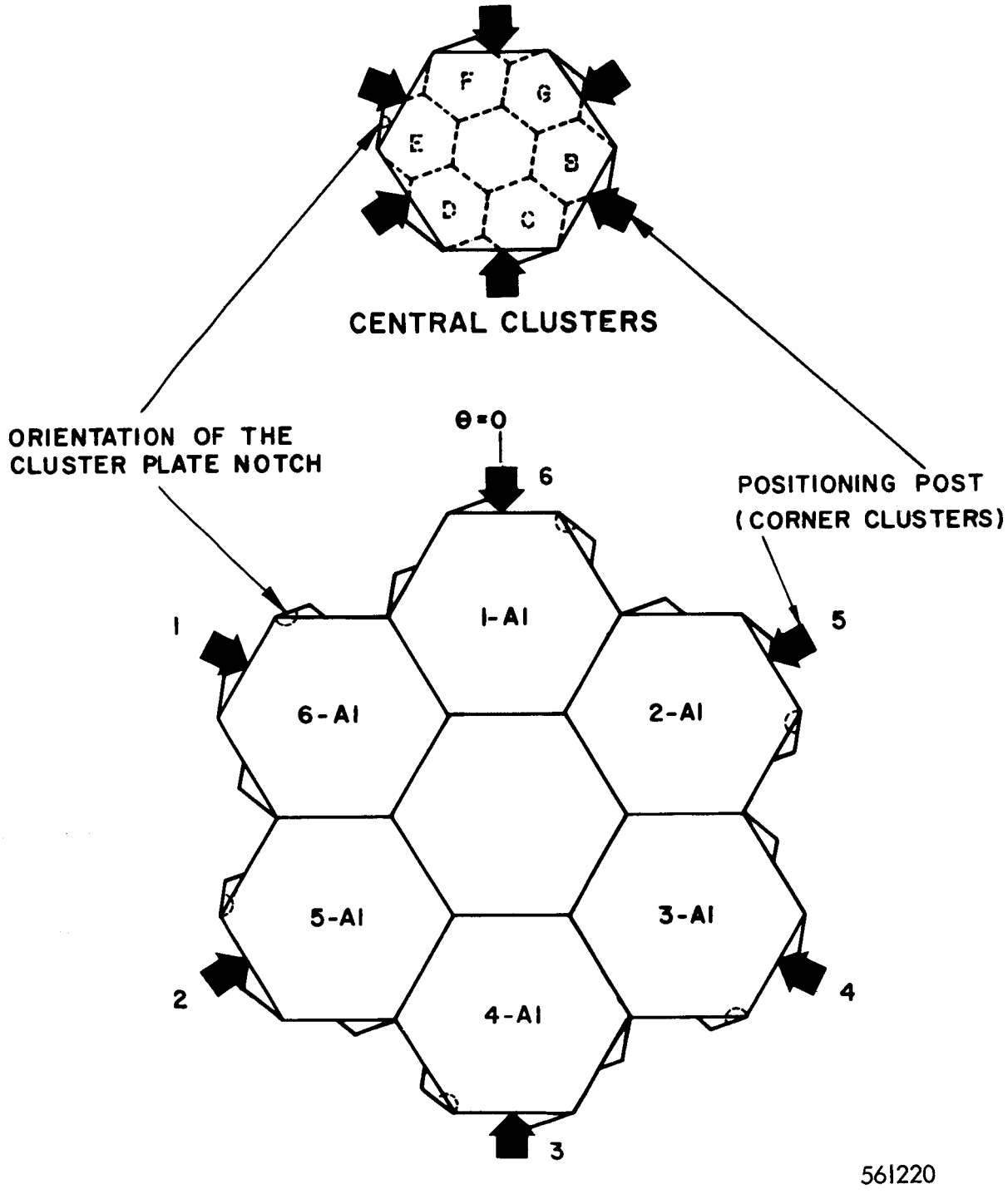

Figure 7 - 8 Nozzle End View Showing Cluster Location, Orientation and Sequence

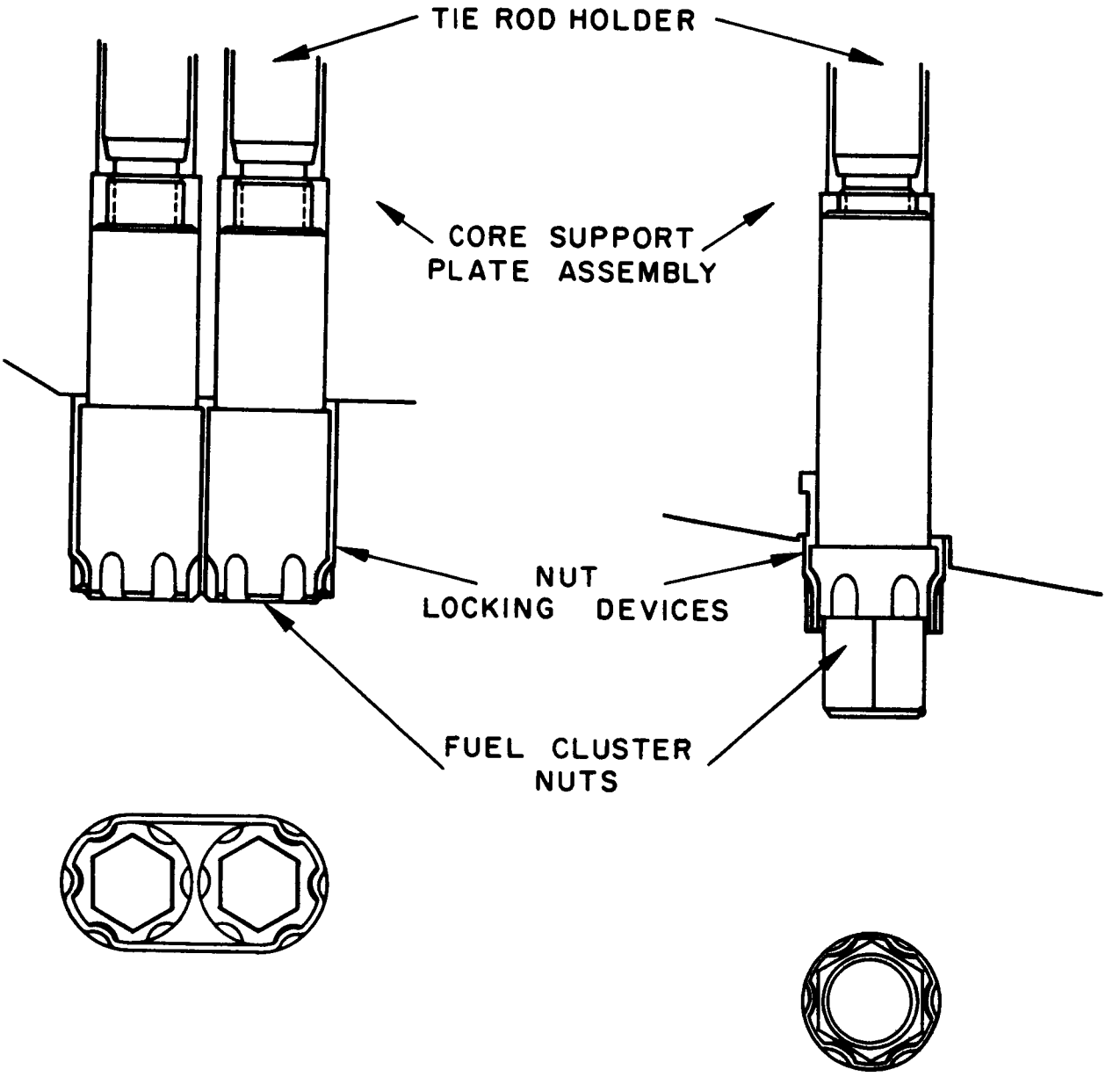

Figure 7 - 9 Fastening of Tie Rod Holders

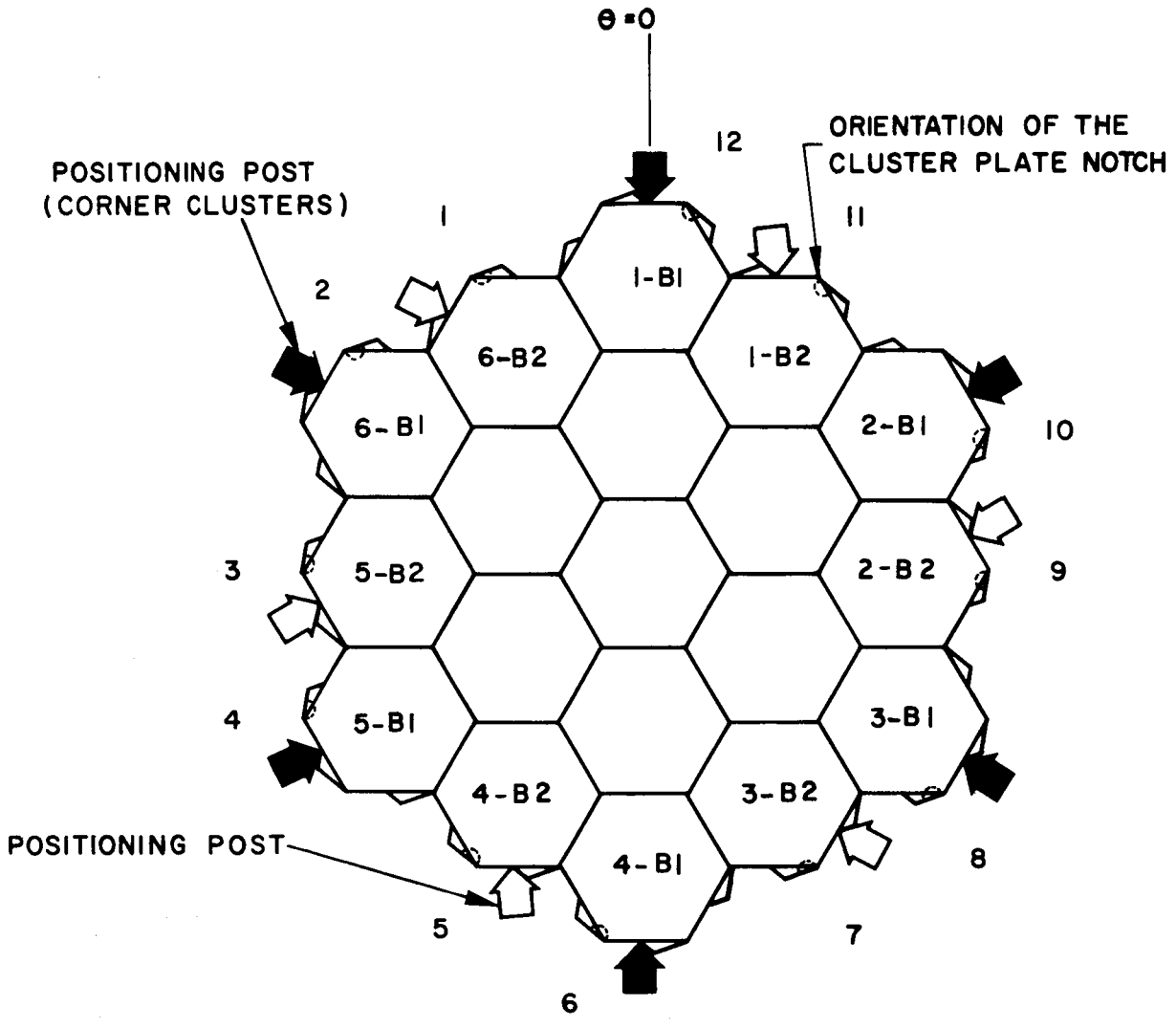

Figure 7 - 10 2nd Row of Clusters, Nozzle End View Showing Cluster Location, Orientation and Sequence

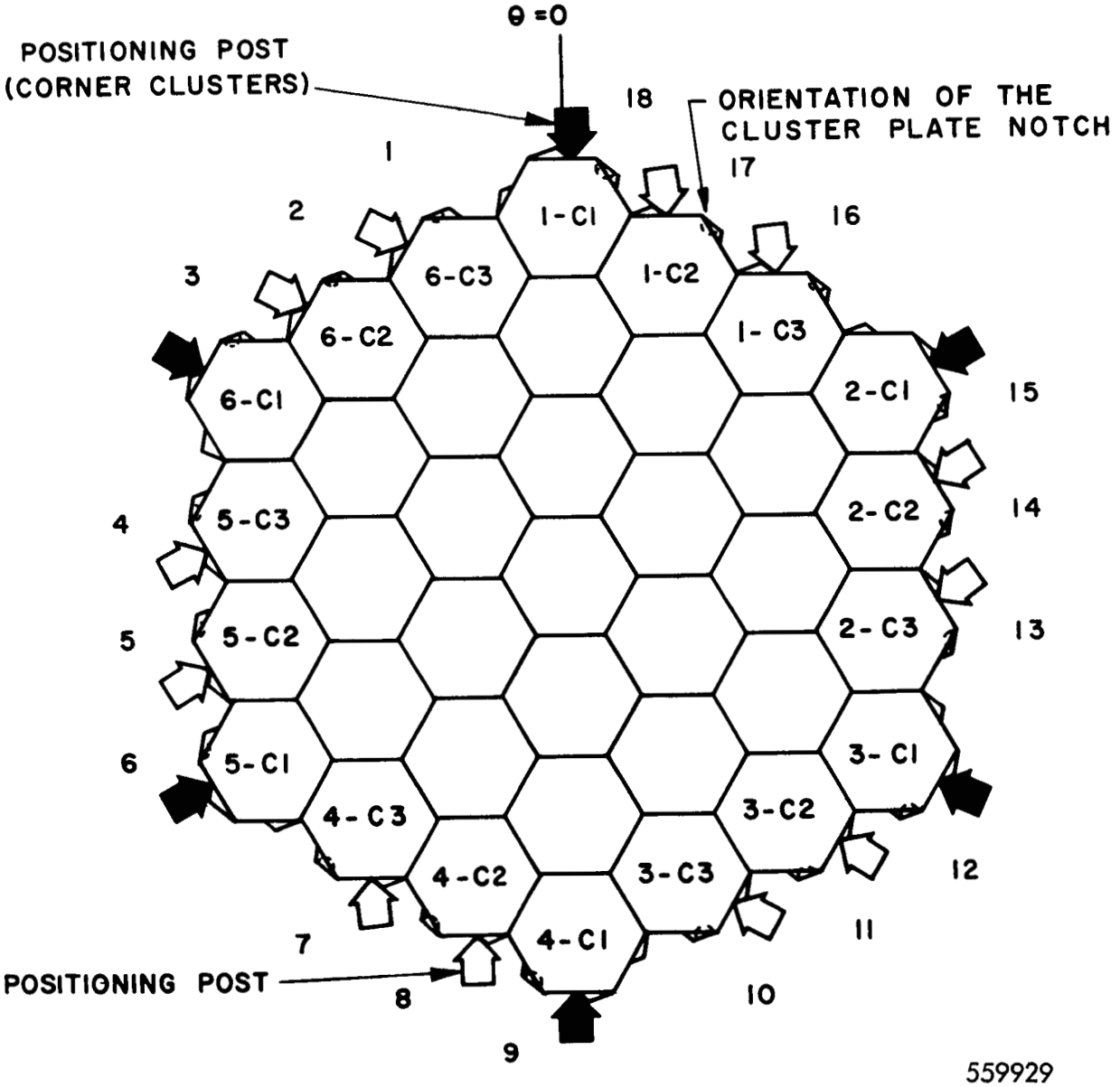

Figure 7 - 11 3rd Row of Clusters, Nozzle End View Showing Cluster Location, Orientation and Sequence

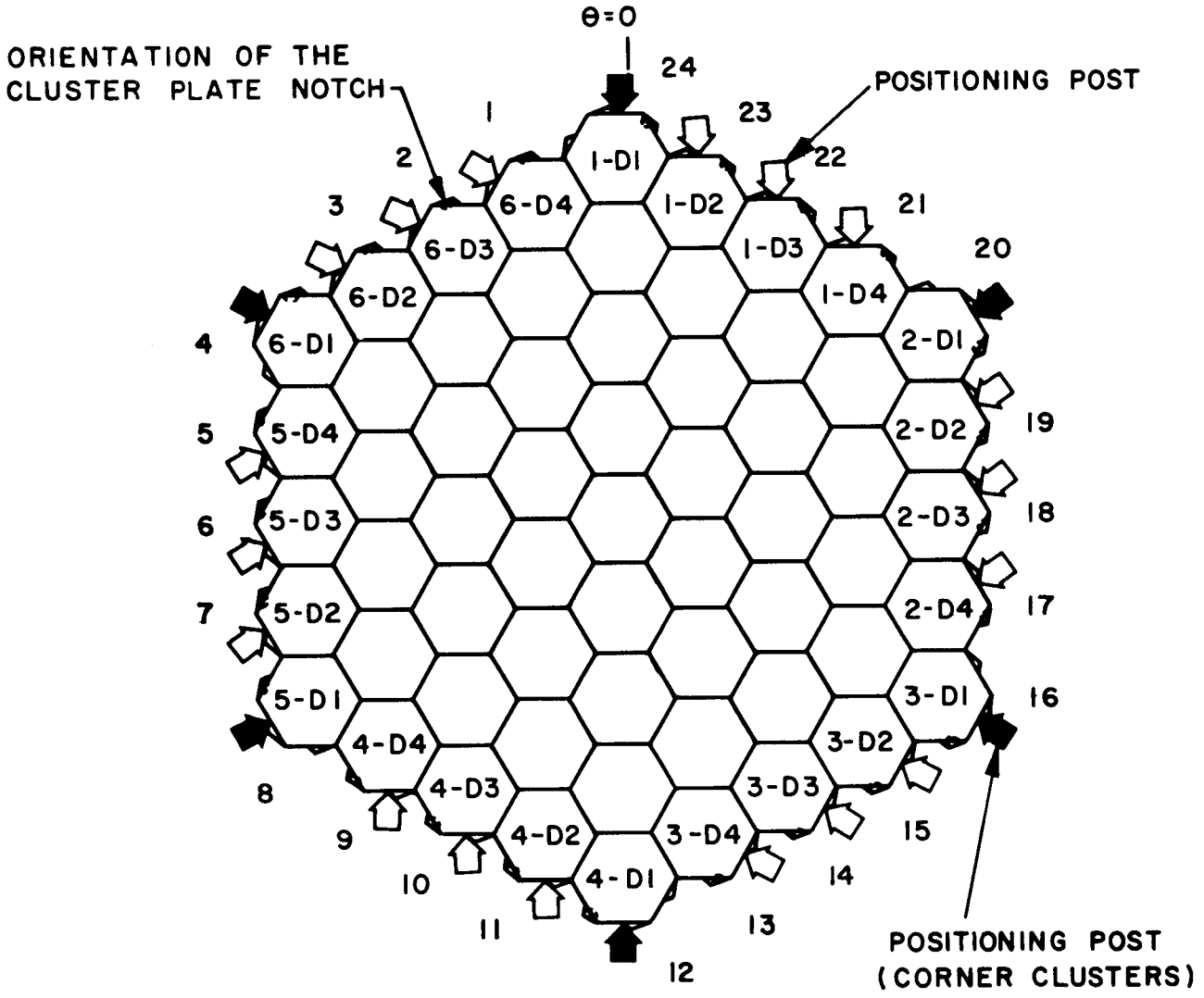

Figure 7 - 12 4th Row of Clusters, Nozzle End View Showing Cluster Location, Orientation and Sequence

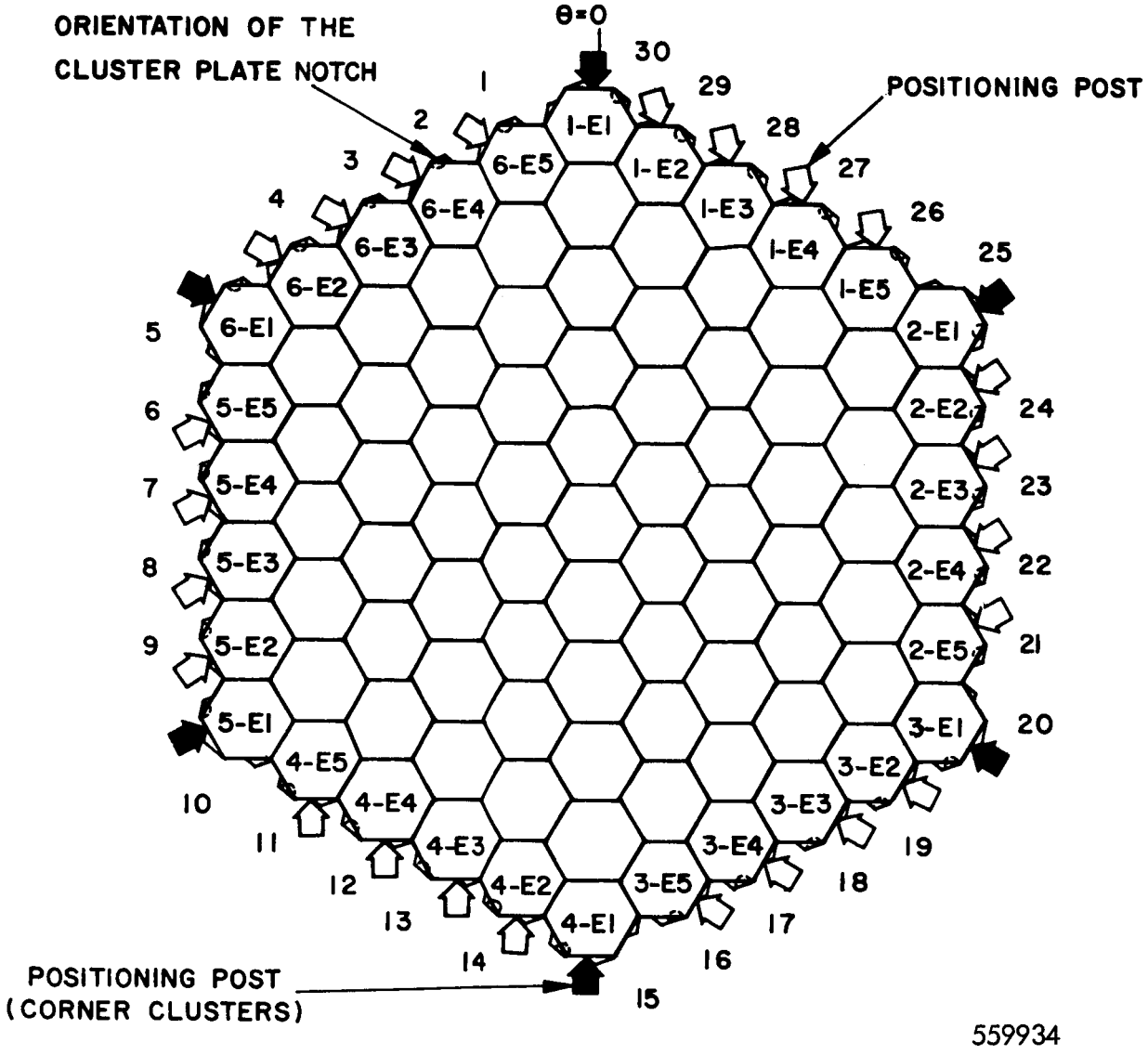

Figure 7 - 13 5th Row of Clusters, Nozzle End View Showing Cluster Location, Orientation and Sequence

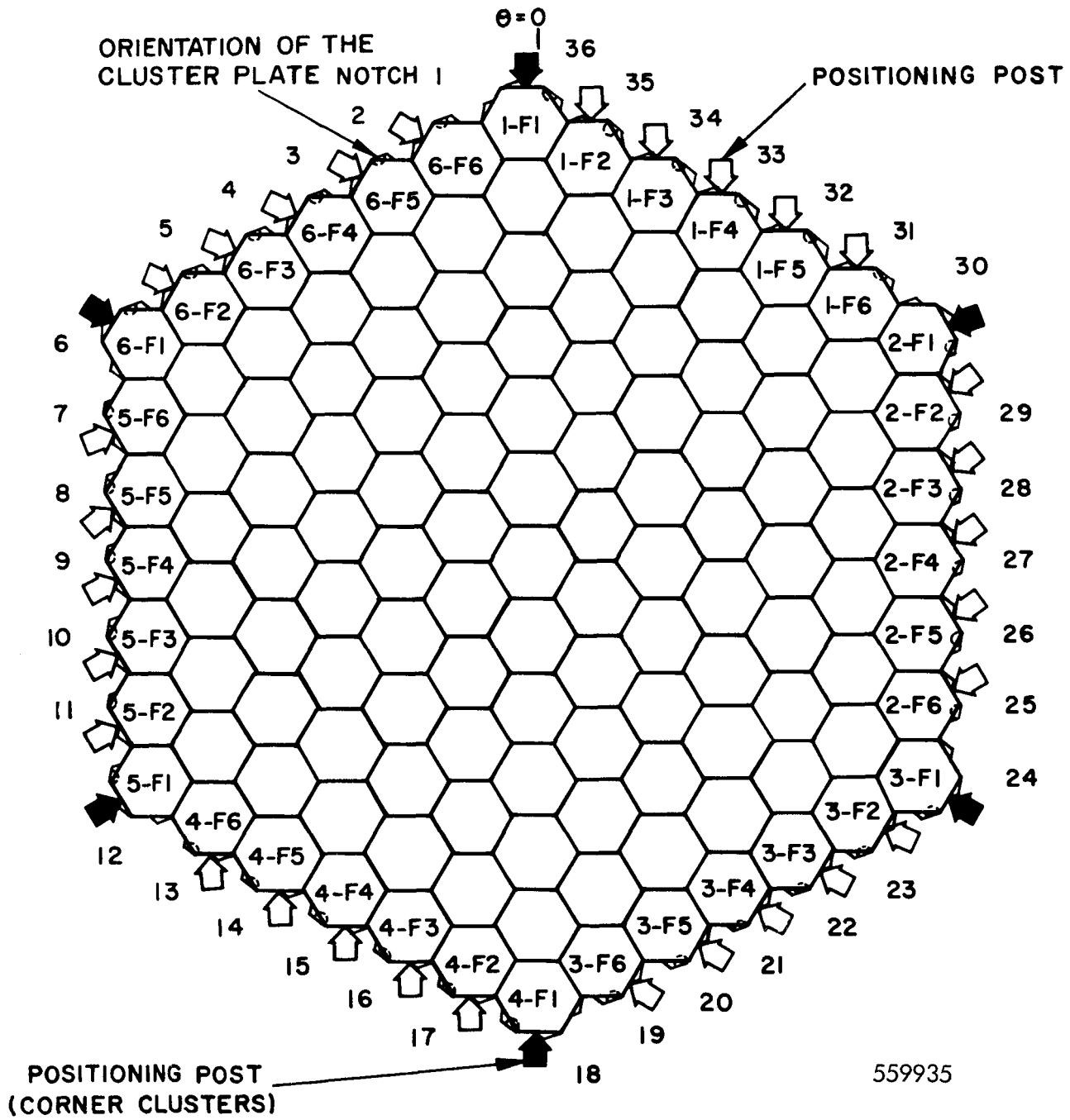

Figure 7 - 14 6th Row of Clusters, Nozzle End View Showing Cluster Location, Orientation and Sequence

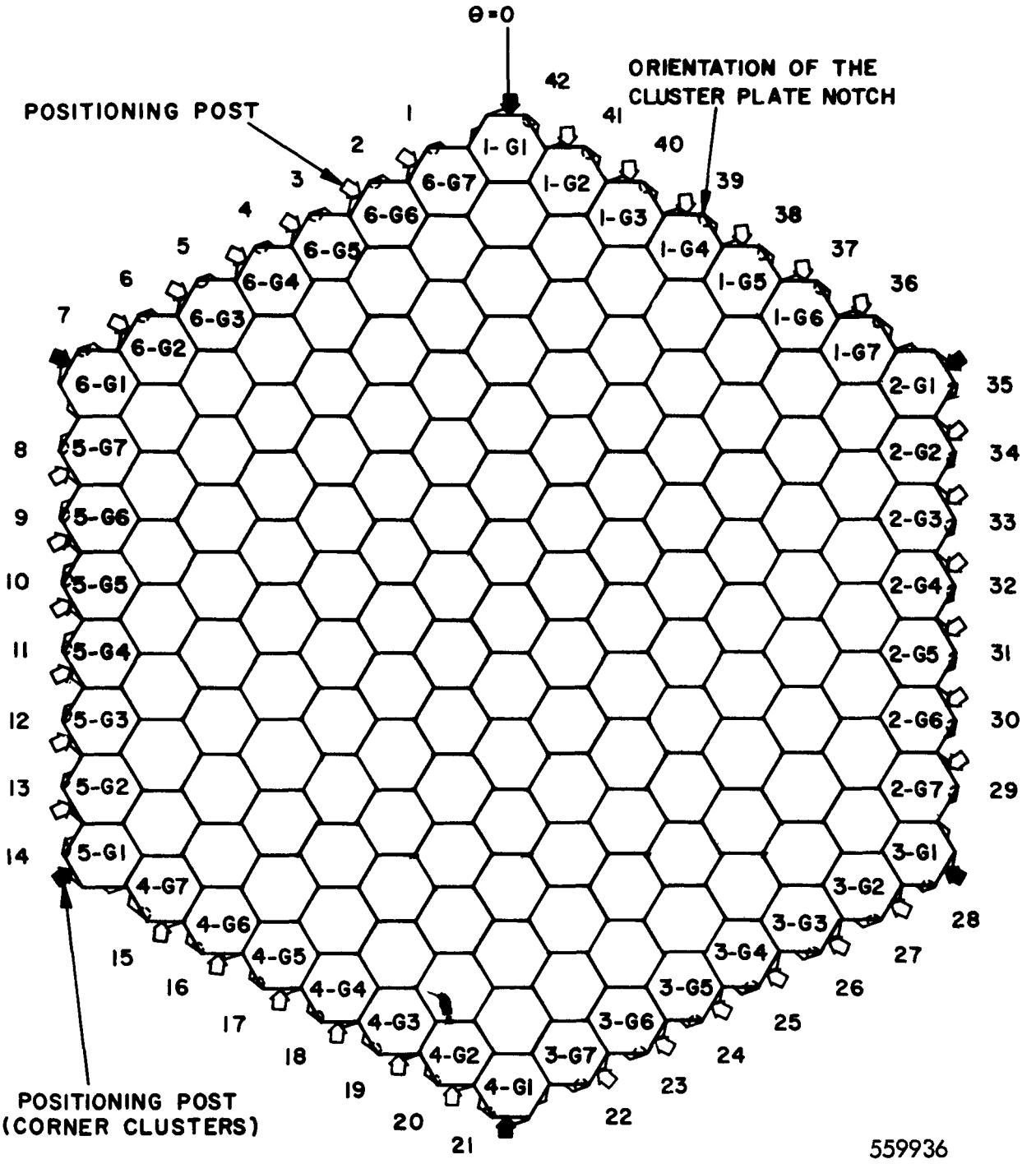

Figure 7 - 15 7th Row of Clusters, Nozzle End View Showing Cluster Location, Orientation and Sequence

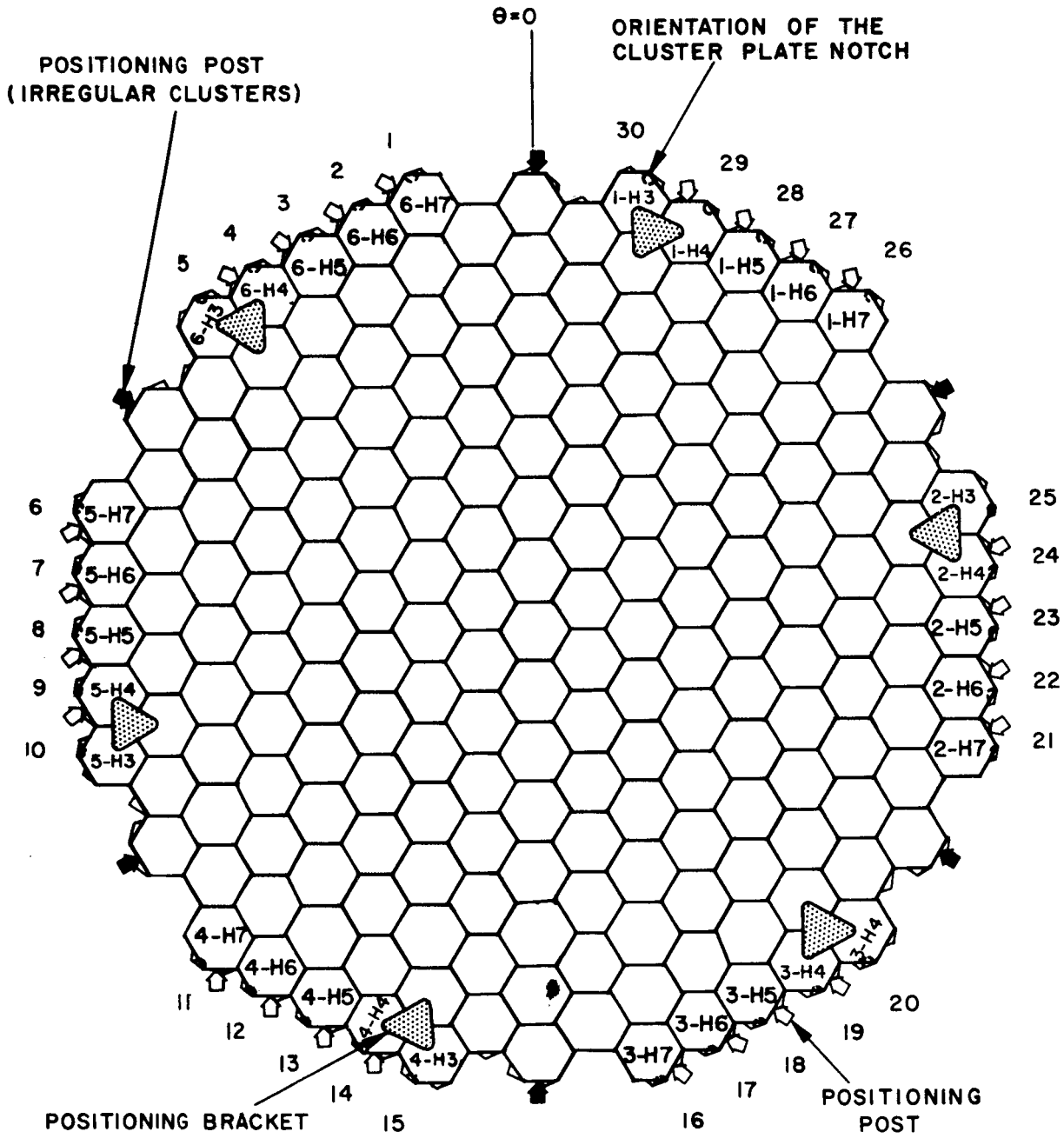

Figure 7 - 16 8th Row of Clusters, Nozzle End View Showing Cluster Location, Orientation and Sequence

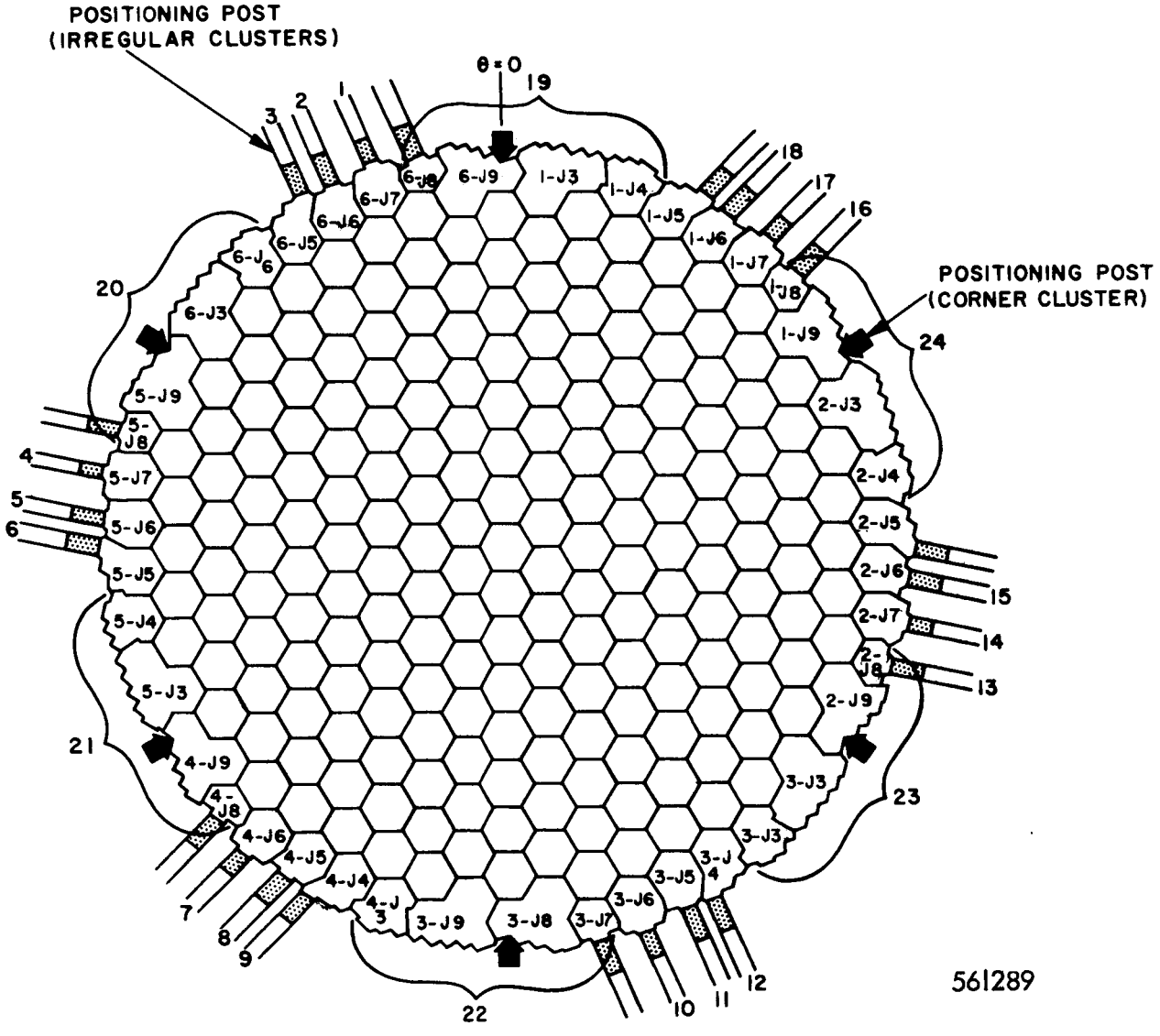

Figure 7 - 17 9th Row of Clusters, Nozzle End View Showing Cluster Location, Orientation and Sequence

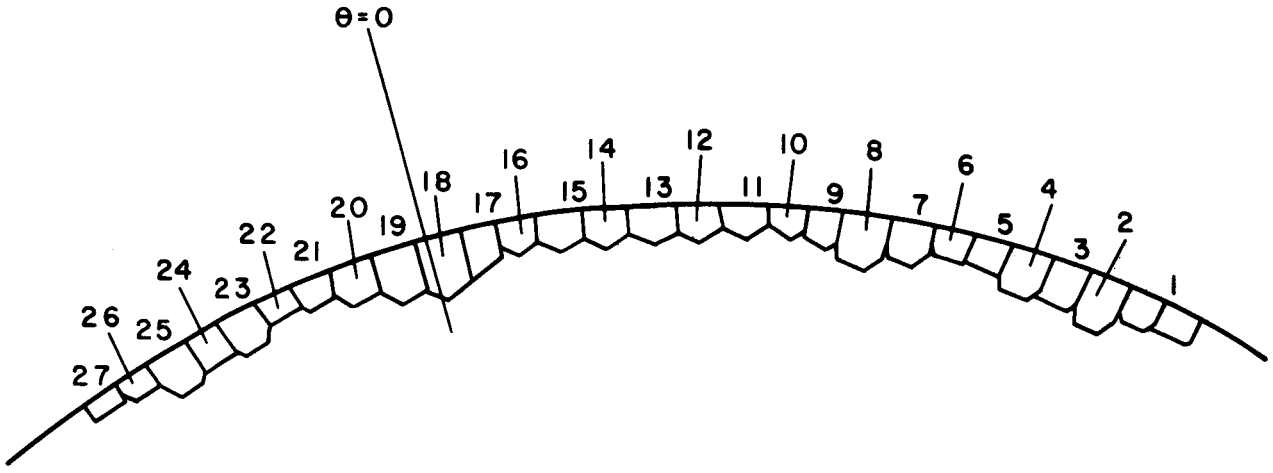

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Figure 7 - 18 Location of the Gauge Fixtures and Filler Strips, Nozzle End View

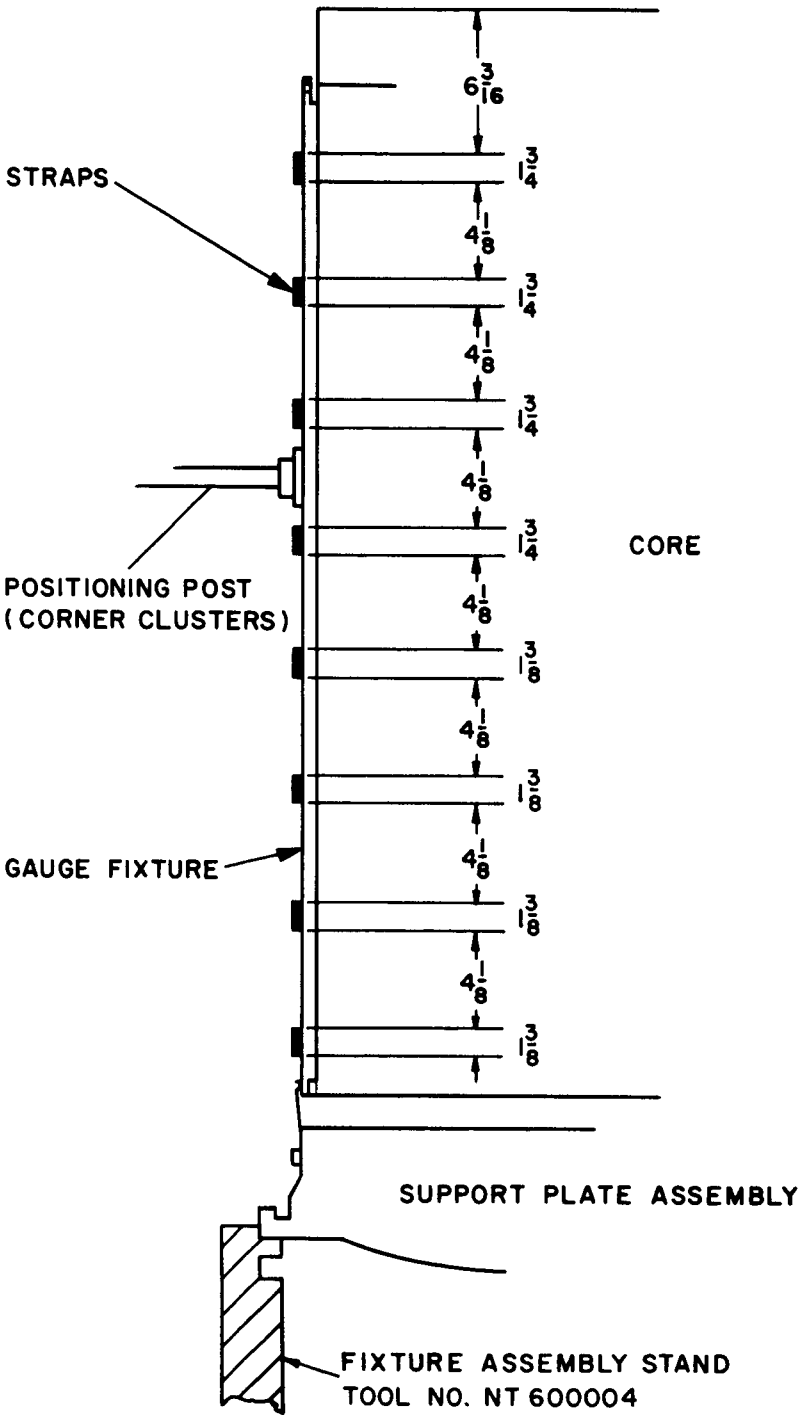

Figure 7 - 19 Location of the Straps

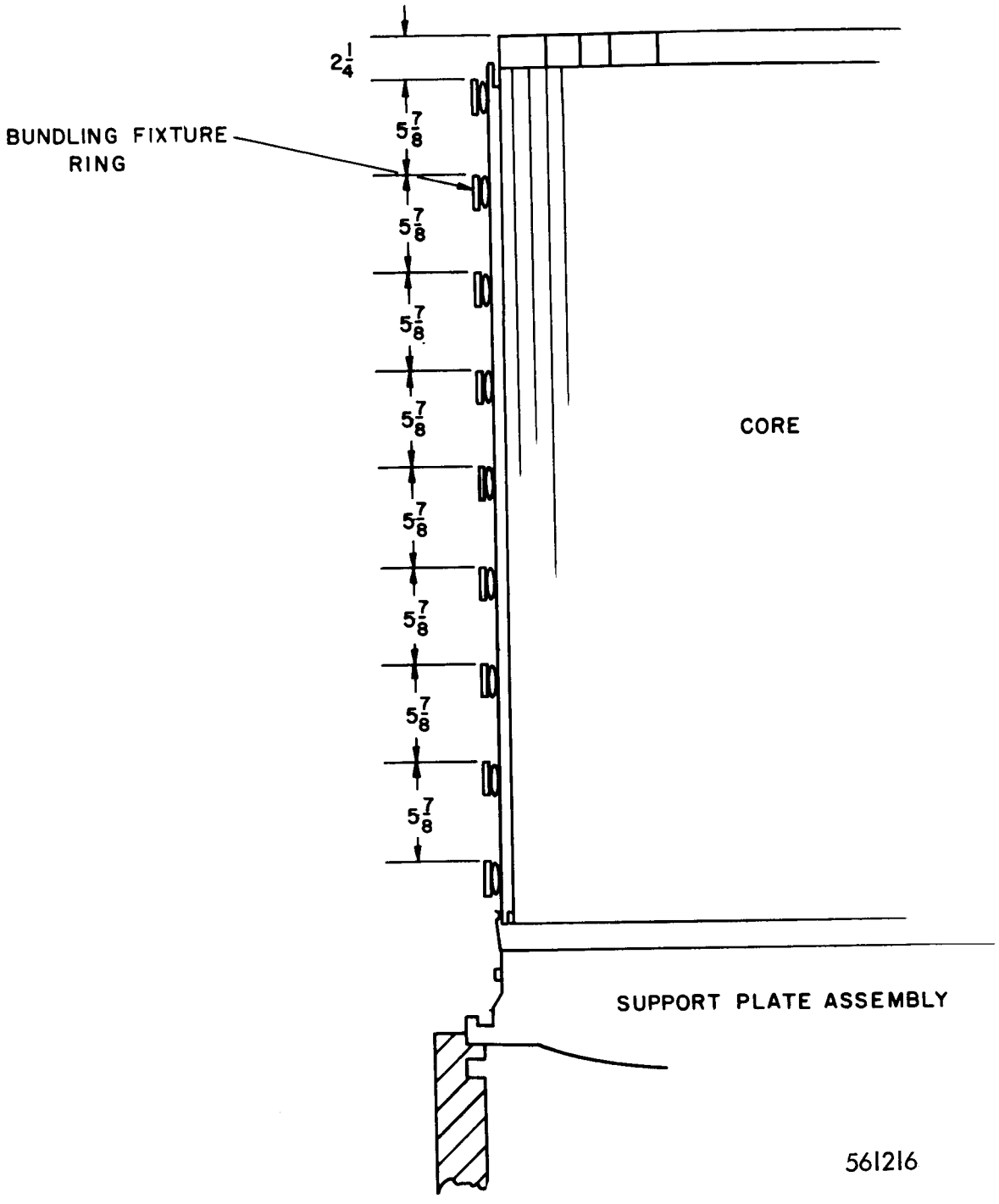

Figure 7 - 20 Location of the Bundling Rings

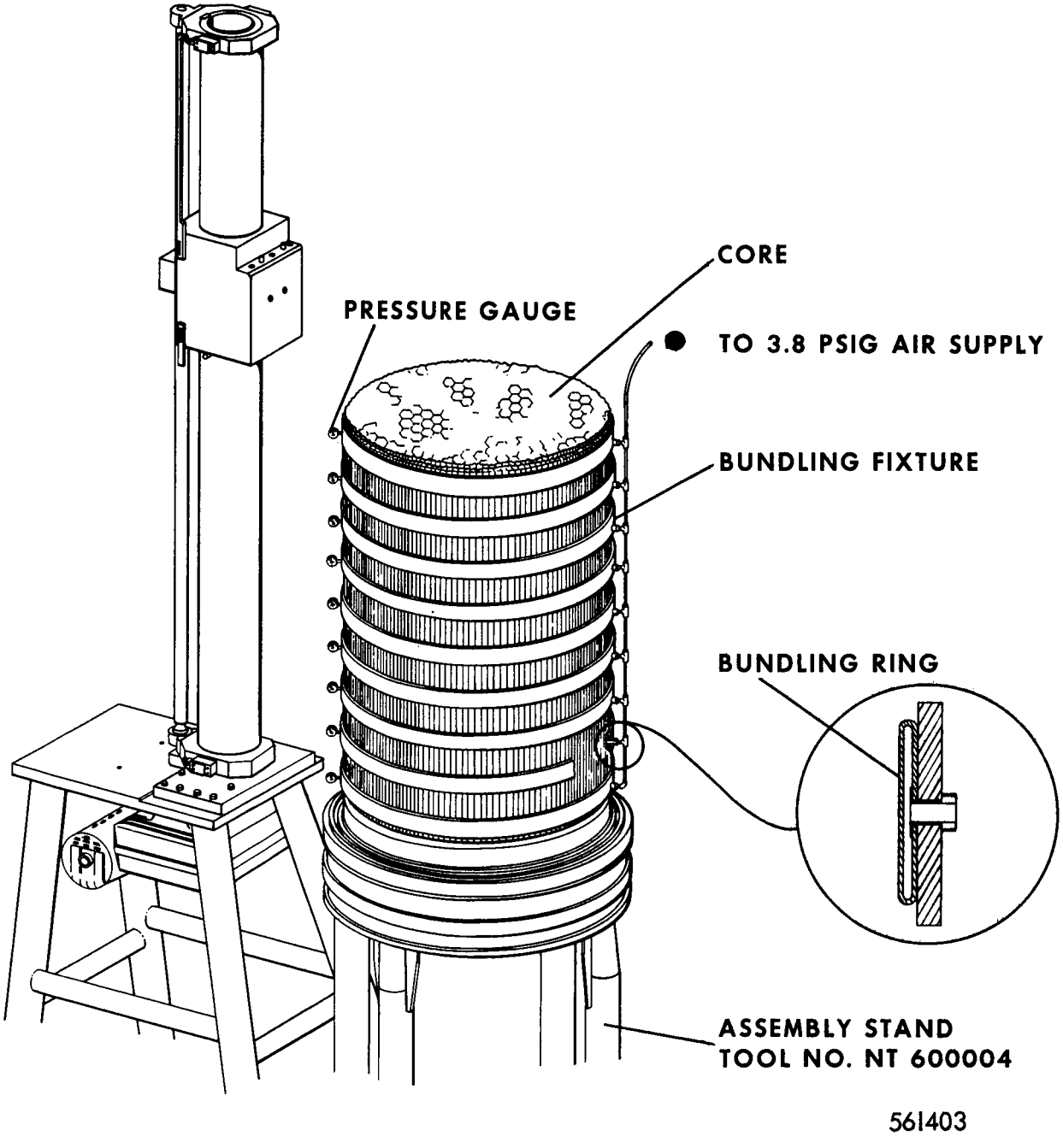

Figure 7 - 21 Bundling of the Core

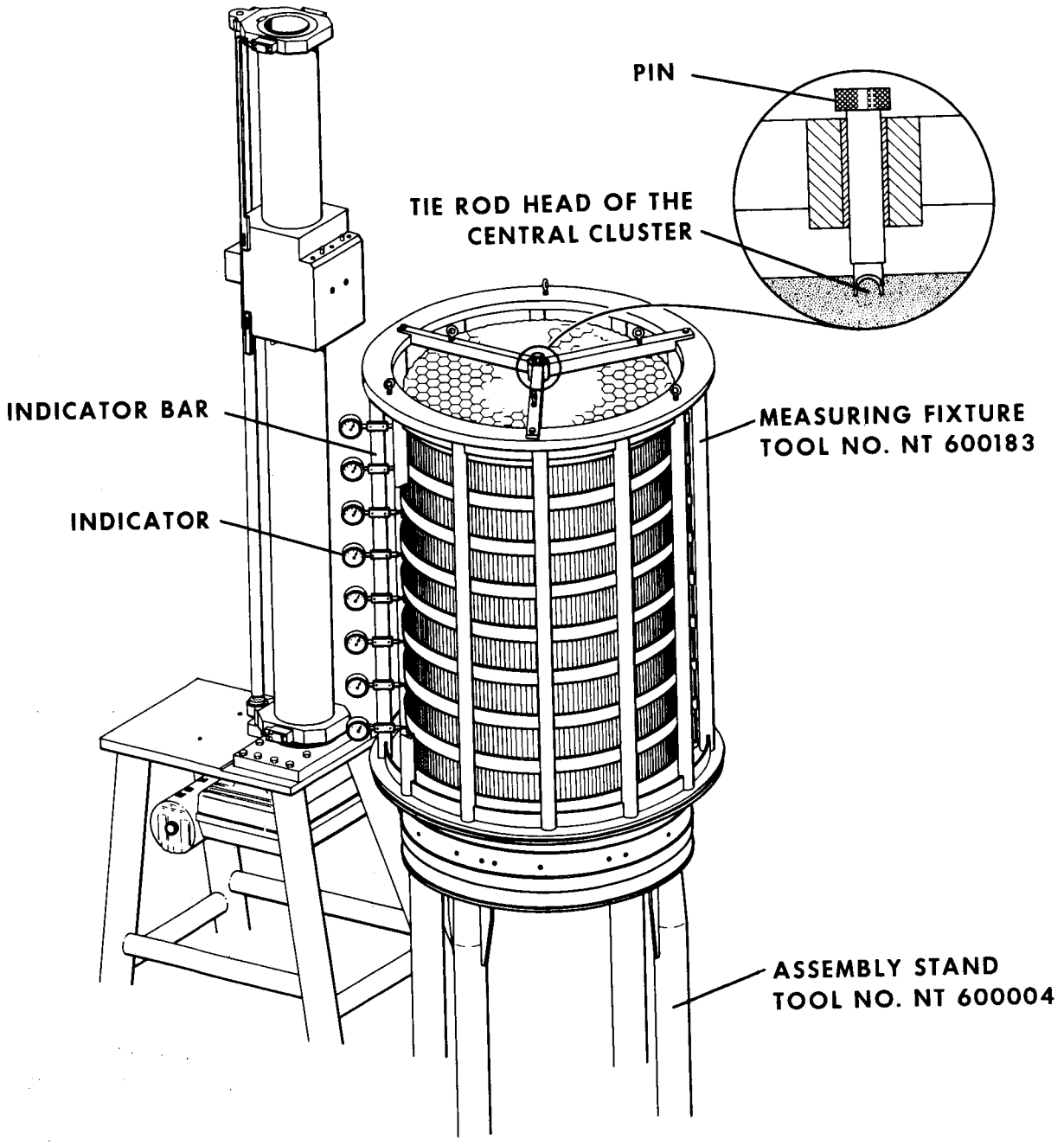

Figure 7 - 22 Measuring the Core Diameter

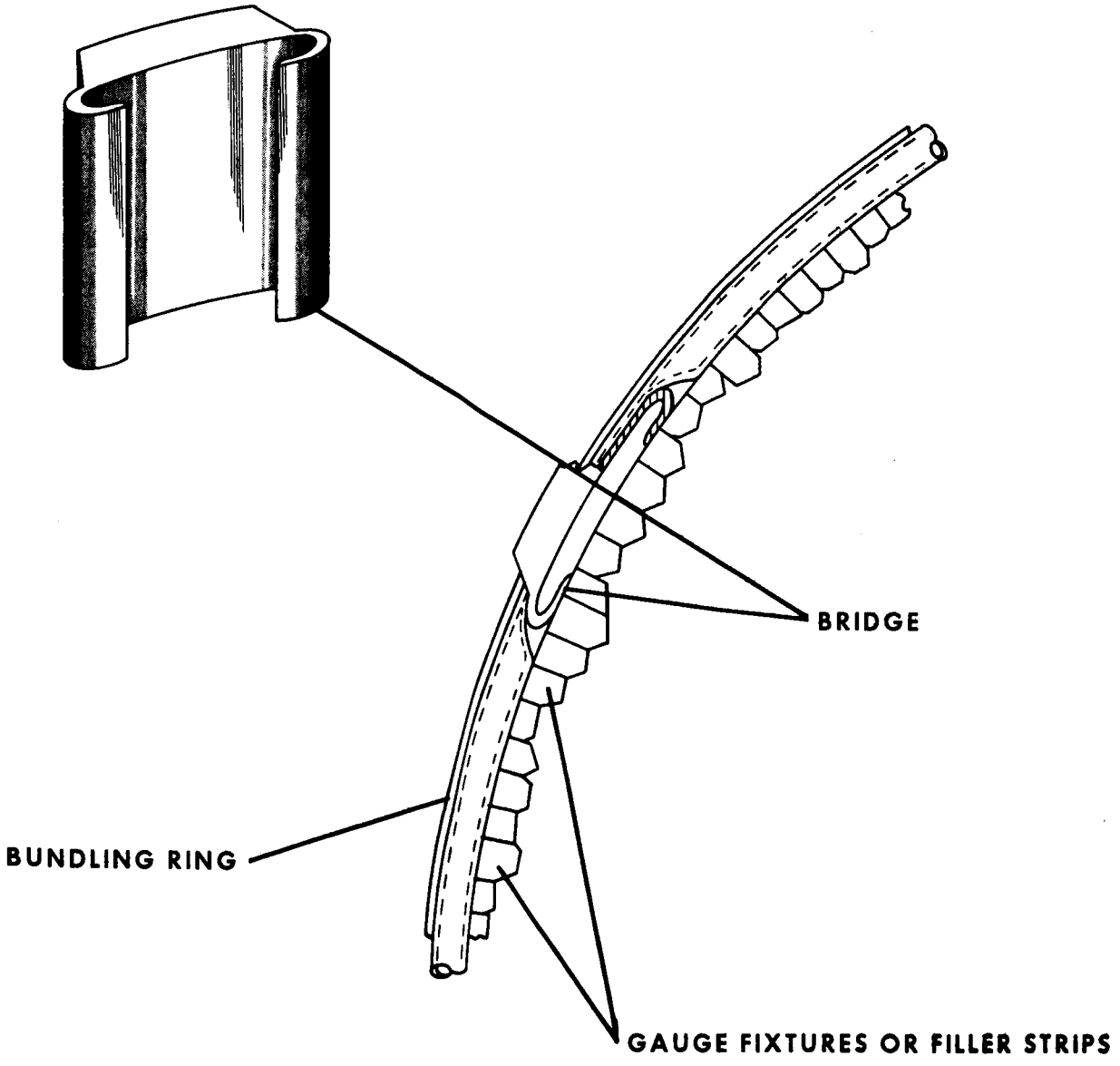

Figure 7 - 23 Installation of Filler Strips

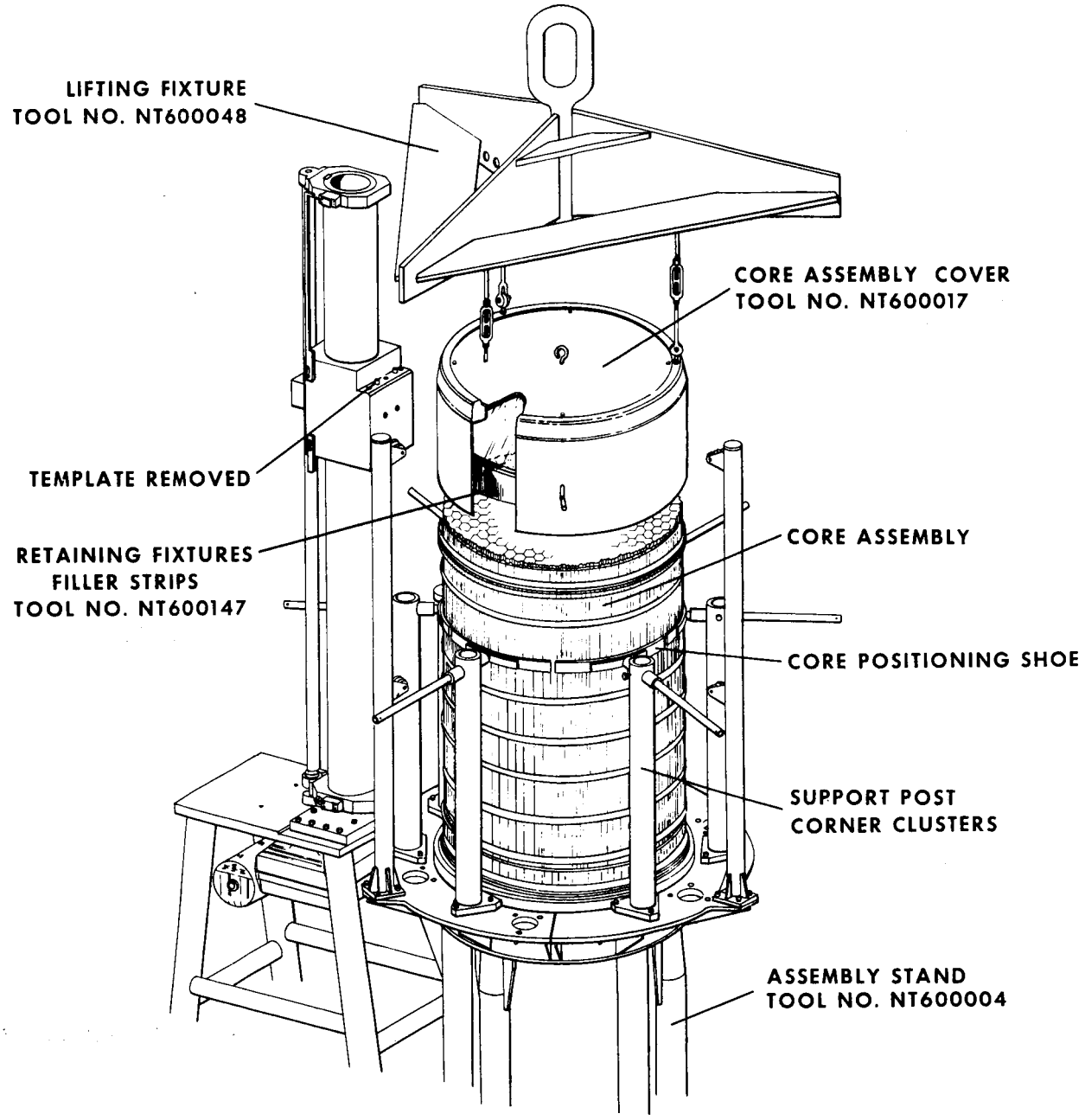

Figure 7 - 24 Completed Core Assembly on the Assembly Stand

SECTION VIII

ASSEMBLY OF THE INNER REFLECTOR

PREPARATION AND HANDLING:

For details of assembly tools refer to Figure Nos. 8-1 and 8-2.

Prepare the INNER REFLECTOR ASSEMBLY STAND ELEVATOR, Tool No. NT 600008, and the ASSEMBLY STAND, Tool No. NT 600015 as follows:

1. Level the FIXTURE Seating surface of the ASSEMBLY STAND, Tool No. NT 600015, in two perpendicular directions using the LEVELING JACKS and spanner wrench supplied with the ASSEMBLY STAND.
2. Center the INNER REFLECTOR ASSEMBLY STAND ELEVATOR in the ASSEMBLY STAND. Level the INNER REFLECTOR ASSEMBLY STAND ELEVATOR in two (2) perpendicular directions on the BASE using the ELEVATOR LEVELING JACKS.

NOTE

THE ELEVATOR CAN BE ROTATED THROUGH 360° AND LOCKED AT 90° INCREMENTS WITH THE LOCATING PIN.

3. Place the INNER REFLECTOR ASSEMBLY FIXTURE, Vibration Test, Tool No. NT 600184 on the FIXTURE.

Refer to the following Reactor Assembly Process Outlines:

For location of parts, refer to Figure Nos. 8-3 and 8-4.

WARNING

OBSERVE THE HEALTH AND SAFETY PRECAUTIONS FOR HANDLING RADIOACTIVE MATERIAL AS OUTLINED IN THE CRITICALITY HAZARDS CONTROL GUIDE, WANL-TME-185. IN ADDITION, THE REACTOR ASSEMBLY AREA CRITICALITY HAZARDS CONTROL PROCEDURES, RA-048 MUST BE OBSERVED.

The assembly of the Inner Reflector is performed as follows:

1. Place the INNER REFLECTOR RING, Tool No. NT 600063 on the DOME END of the INNER REFLECTOR CYLINDER, align the $\theta = 0$ marks and fasten the INNER REFLECTOR RING to the DOME END.
2. Using the overhead crane, the LIFTING FIXTURE, Tool No. NT 600048, and the LIFTING FIXTURE, Tool No. NT 600011 (see Figure No. 8-5) place the INNER REFLECTOR CYLINDER on the FIXTURE of the ASSEMBLY STAND. Align the $\theta = 0$ marks on the INNER REFLECTOR CYLINDER and the ASSEMBLY STAND.

CAUTION

INNER REFLECTOR CYLINDER
IS MADE FROM BRITTLE MATERIAL.
HANDLE WITH CARE.

3. Remove the LIFTING FIXTURE, Tool No. NT 600048 and the INNER REFLECTOR RING, Tool No. NT 600063.

NOTE

THE LIFTING FIXTURE, TOOL NO.
NT 600011 IS TO REMAIN ON THE
ASSEMBLY STAND.

4. Install the first row of SEAL SEGMENTS at the nozzle end in the retracted position and locate with the LOCATING FIXTURE SEAL SEGMENTS, Tool No. 600181. Refer to Figure No. 9-3. Use the INNER REFLECTOR ASSEMBLY STAND ELEVATOR to install the SEAL SEGMENTS.
5. Using the LIFTING FIXTURE, Tool No. NT 600048 and the overhead crane insert the SEAL SEGMENT RETAINING FIXTURE, Tool No. NT 600146 2 inches into the INNER REFLECTOR CYLINDER. After each row of SEAL SEGMENTS has been installed lower the SEAL SEGMENT RETAINING FIXTURE 1/2 inch past the SEAL SEGMENTS. Continue as described above until all rows of the SEAL SEGMENTS have been installed. Lower the SEAL SEGMENT RETAINING FIXTURE until its flange rests on the nozzle end of the INNER REFLECTOR

Astronuclear

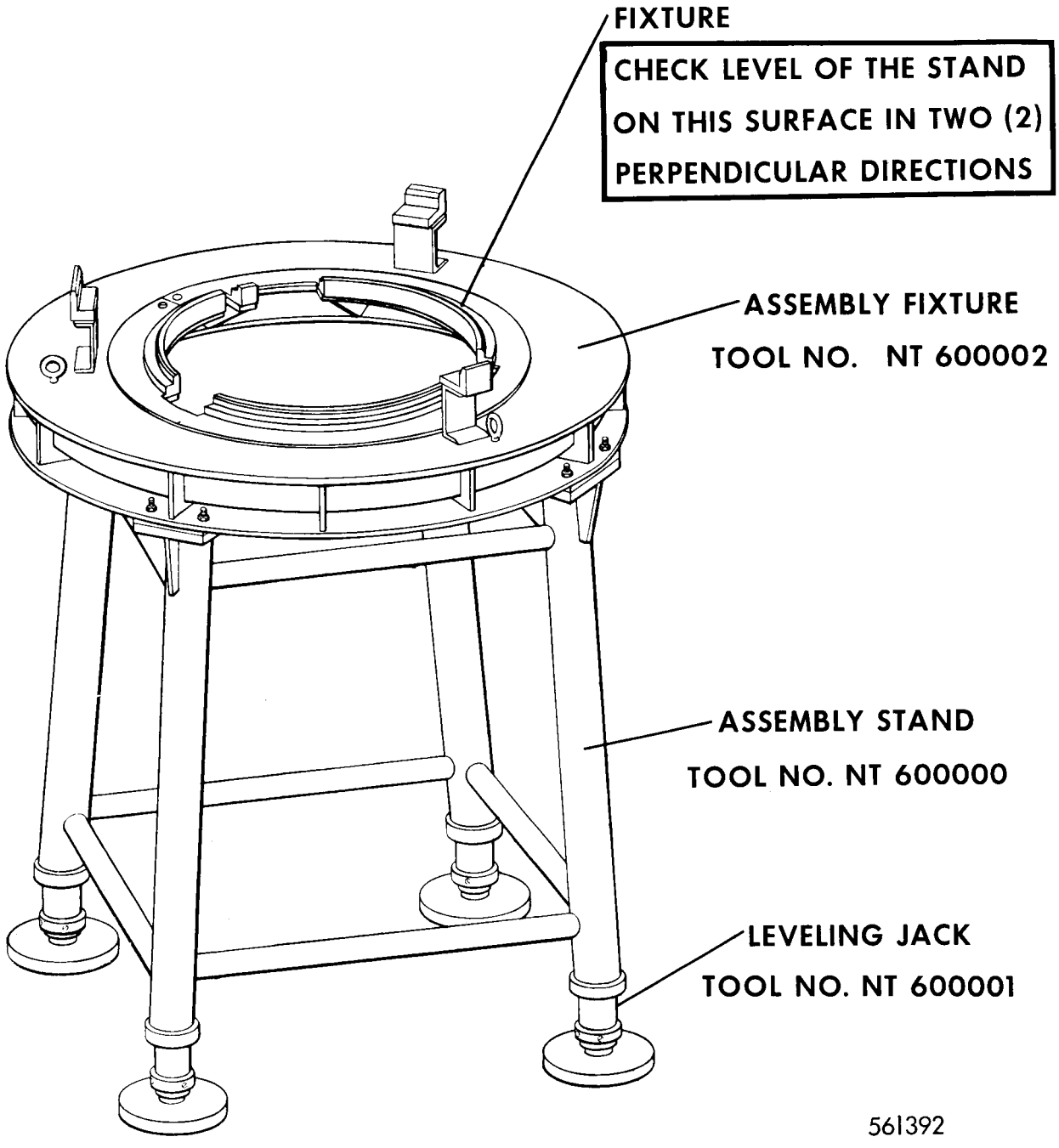

Figure 8 - 1 Assembly Stand Tool NT 600015

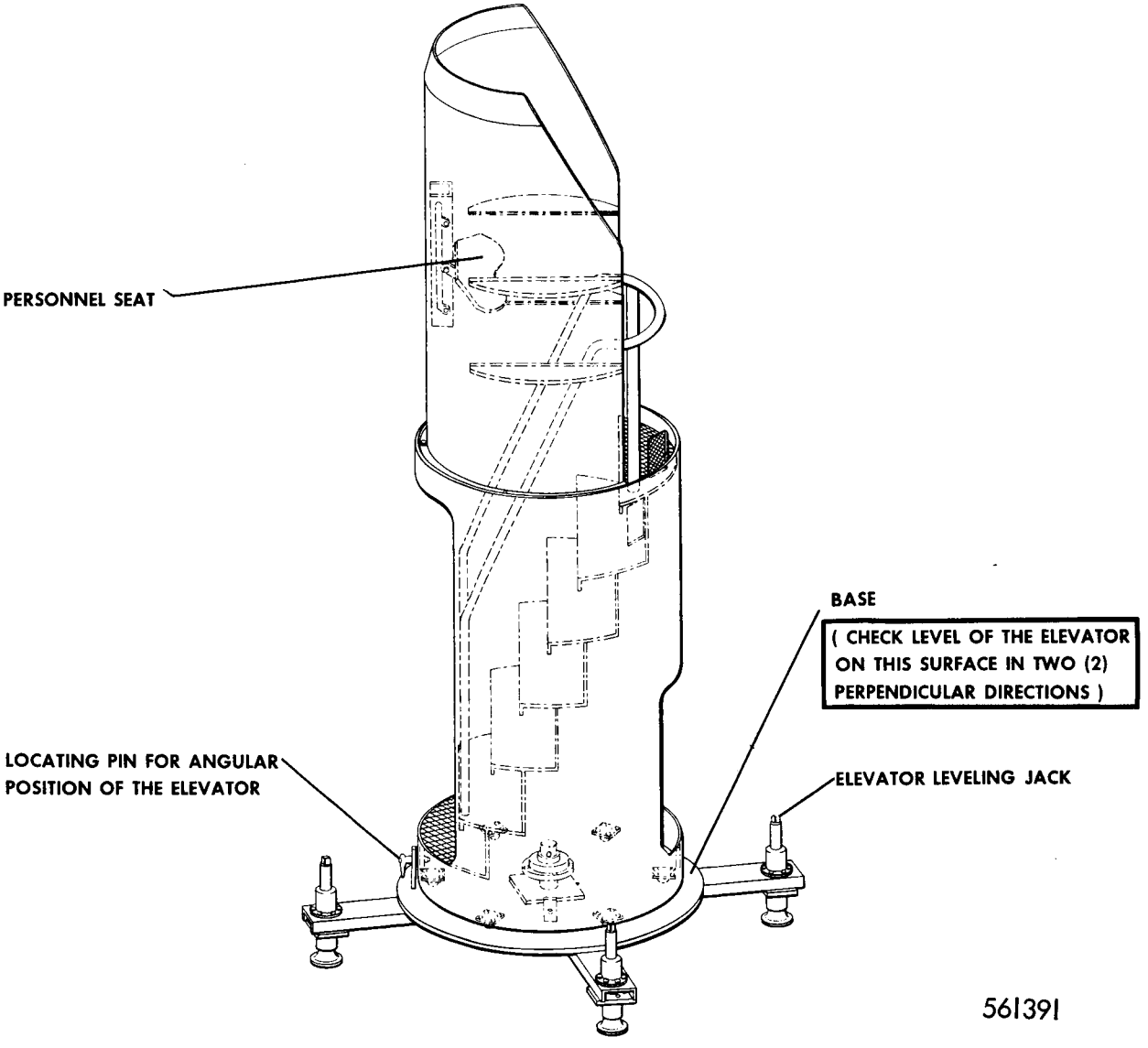

Figure 8 - 2 Inner Reflector Assembly Stand Elevator Tool No. NT 600005

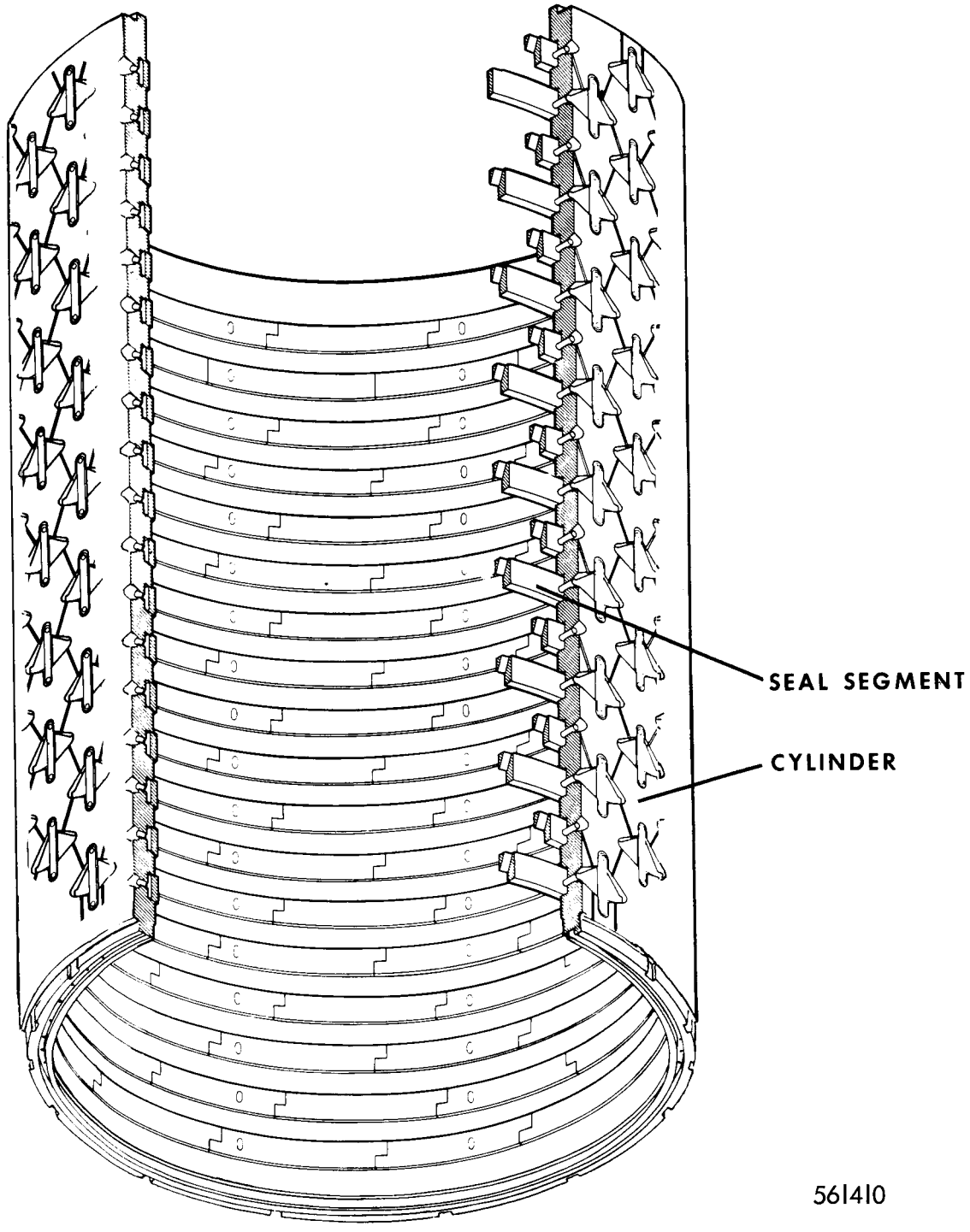

Figure 8 - 3 Inner Reflector Assembly

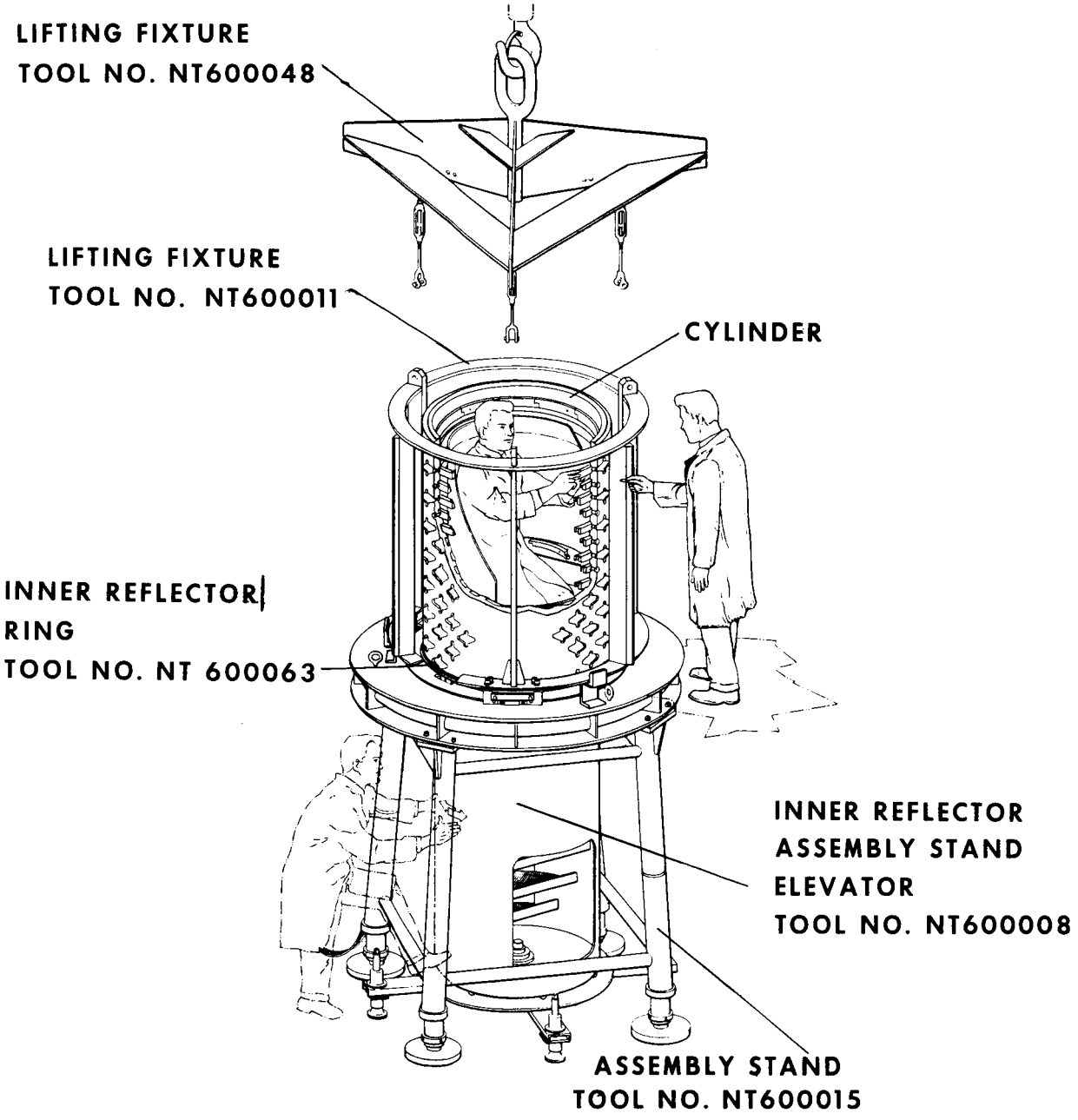

Figure 8 - 4 Assembly of Inner Reflector

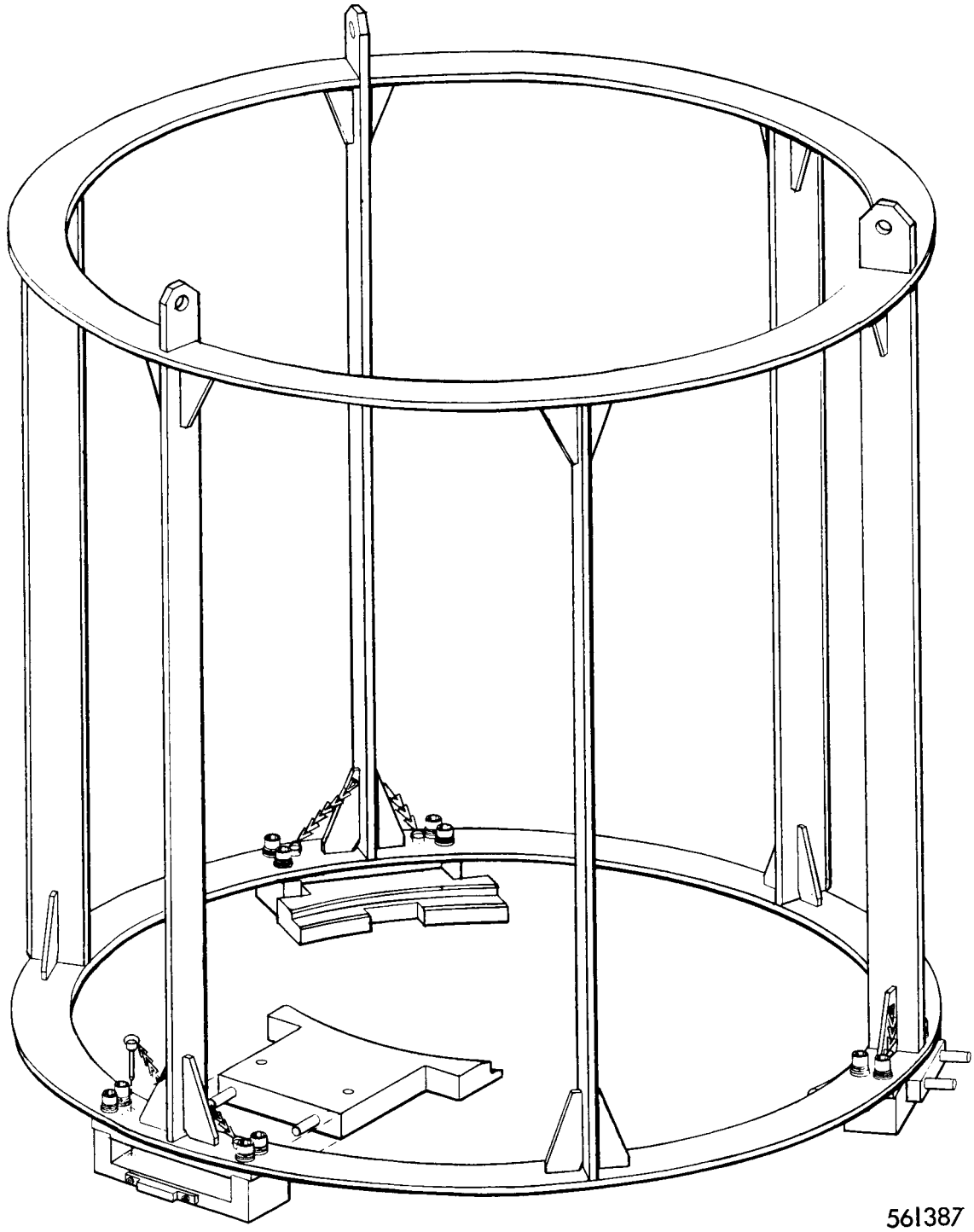

Figure 8 - 5 Lifting Fixture Tool No. NT 600011

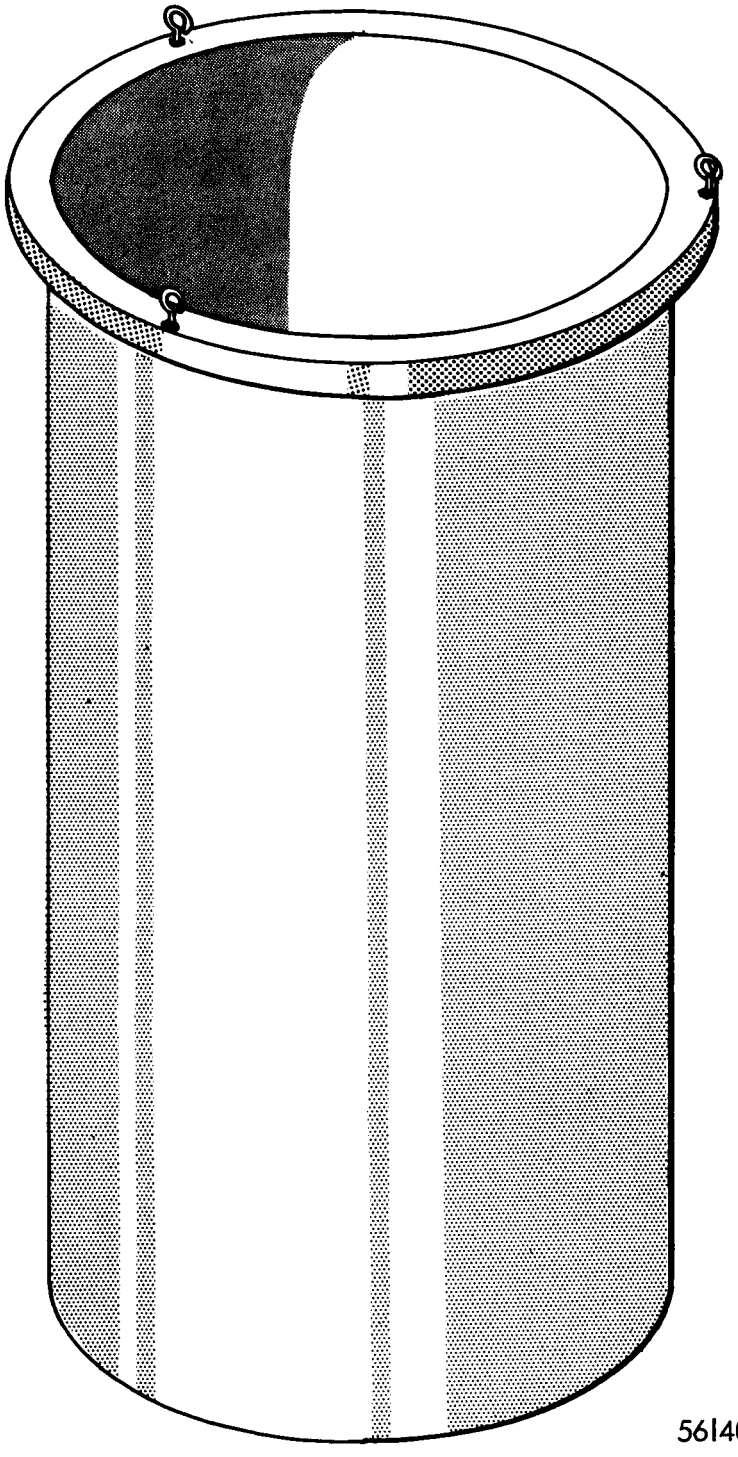

Figure 8 - 6 Retaining Fixture Seal Segment Tool No. NT 600146

SECTION IX

ASSEMBLY OF THE CORE AND INNER REFLECTOR

For location of parts, refer to Figure Nos. 9-1 and 9-2.
Refer to the Reactot Assembly Process Outline RAPO NO. 5001 titled, "Reactor Assembly".

WARNING

MAKE SURE THE CORE IS
BUNDLED WITH THE STRAPS.

1. Remove the POSITIONING POSTS (corner clusters) equipped with CORE POSITIONING SHOES.
2. For the torsional and the lateral vibration tests install the SIMULATED SUPPORT RING, the SPRING RETAINERS the SPRINGS PRELOAD, the SPRING RETAINERS and the SPRING BEARING RING. For the axial vibration test replace the SIMULATED SUPPORT RING with the actual SUPPORT RING.
3. Move the INNER REFLECTOR ASSEMBLY over the CORE ASSEMBLY using the overhead crane, the LIFTING FIXTURE, Tool No. NT 600011 and the LIFTING FIXTURE, Tool No. NT 600048.
4. Align the $\theta = 0$ points on the CORE ASSEMBLY and the LINER REFLECTOR ASSEMBLY.
5. Engage the LIFTING FIXTURE, Tool No. NT 600011 with the INNER REFLECTOR GUIDE ROLLERS and lower the INNER REFLECTOR ASSEMBLY

over the CORE removing the STRAPS along the way until the INNER REFLECTOR is approximately 2 inches from the top of the POSITIONING POSTS.

6. Remove the POSITIONING POSTS (corner clusters).
7. Lower the INNER REFLECTOR ASSEMBLY on to the SPRING BEARING RING removing the STRAPS along the way.
8. Fasten the SIMULATED SUPPORT RING to the SUPPORT PLATE ASSEMBLY.
9. Remove the LIFTING FIXTURE, Tool No. NT 600011.
10. Remove the three CORE FIXTURE PLATFORMS and the three INNER REFLECTOR GUIDES.
11. Using the overhead crane and the LIFTING FIXTURE, Tool No. NT 600048 withdraw the RETAINING FIXTURE SEAL SEGMENT, Tool No. NT 600146.
12. Using the LOCATING FIXTURES, Tool No. NT 600181 place the SEAL SEGMENTS of the 2nd row from the nozzle end against the core.
13. Remove the CORE ASSEMBLY COVER, Tool No. NT 600017 and the FILLER STRIP RETAINING FIXTURE, Tool No. Nt 600147 and the STRAP.

CAUTION

MAKE SURE ALL THE FILLER STRIP SHOULDERS ARE RESTING ON THE SEAL SEGMENTS OF THE 2nd ROW FROM THE NOZZLE END.

14. Withdraw the LOCATING FIXTURES of the 2nd row of SEAL SEGMENTS from the nozzle end and install the LATERAL SUPPORT PLUNGERS, the LATERAL SUPPORT SPRINGS, the BRACKETS and the SCREWS.
15. Proceed in a manner described above and assemble the remaining rows of LATERAL SUPPORTS.
16. Pre-assemble the DOME SUPPORT RING the OUTER REFLECTOR BACK-UP-RING and the HOLD DOWN PLATE and SPLIT CLAMP RING.
17. Place and attach the above sub-assembly to the simulated or actual CORE SUPPORT RING.

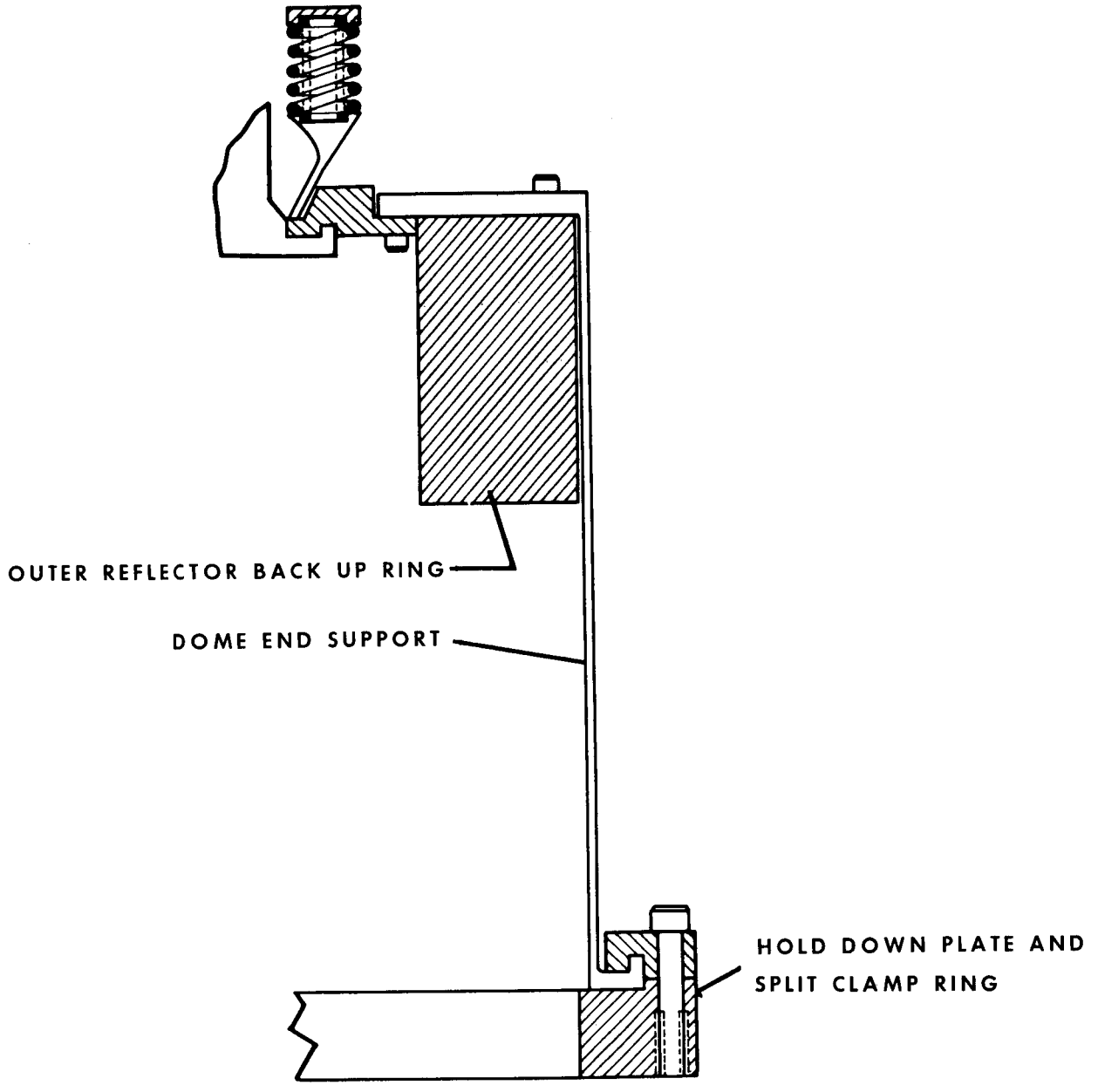

Figure 9 - 1 Assembly of the Core and Dome End Support

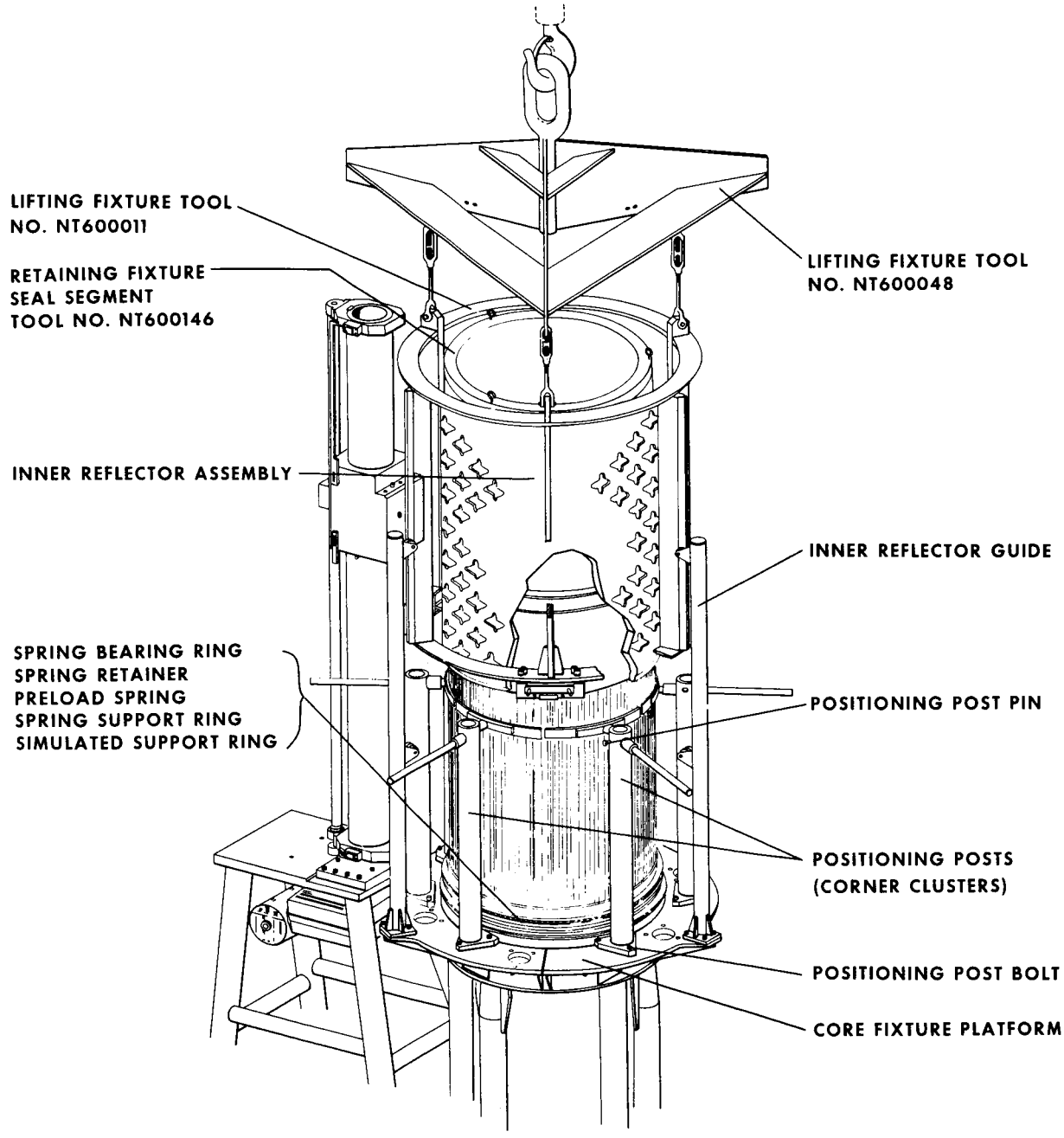

Figure 9 - 2 Assembly of the Core and Inner Reflector

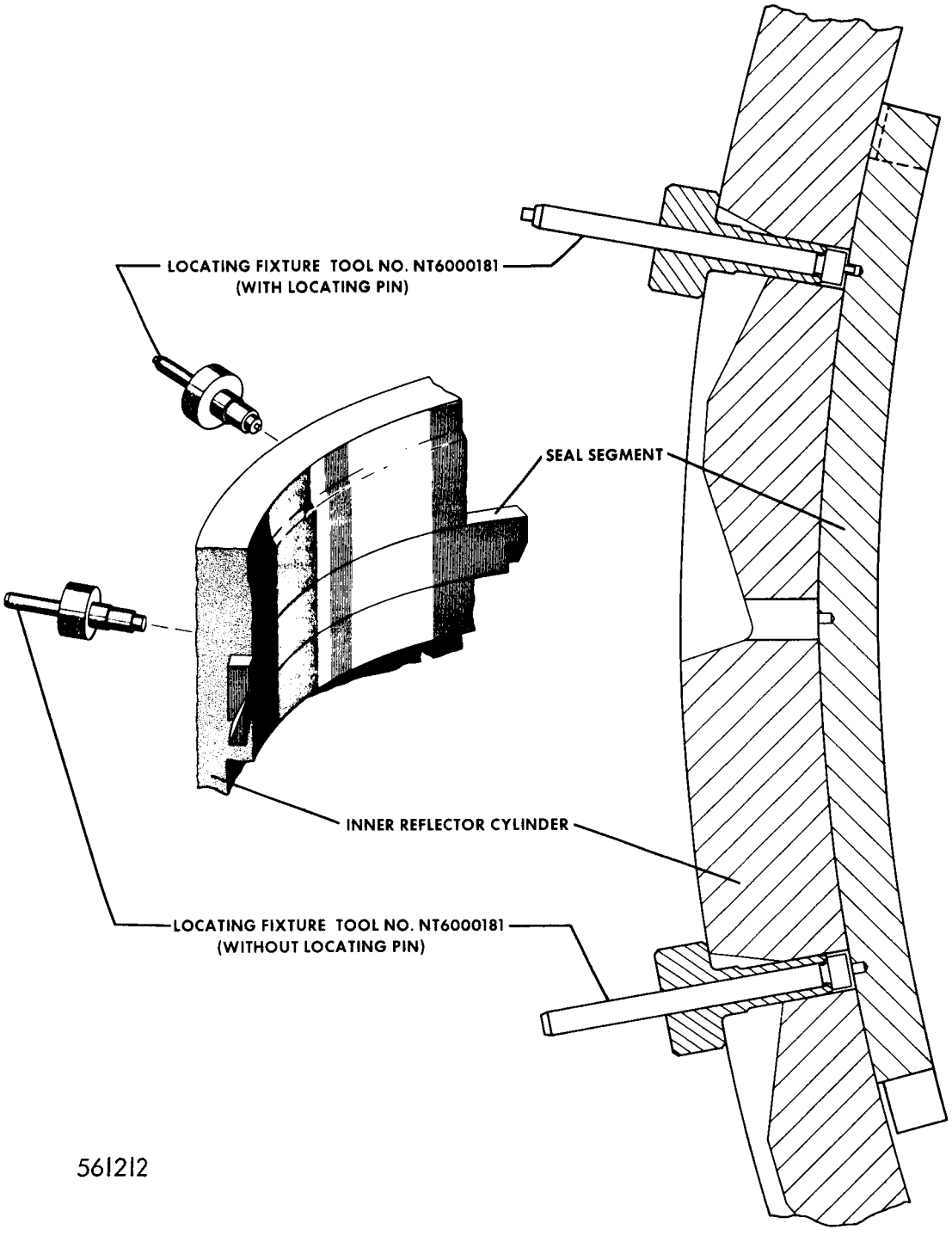

Figure 9 - 3 Locating Fixture Seal Segments Tool No. NT 600181

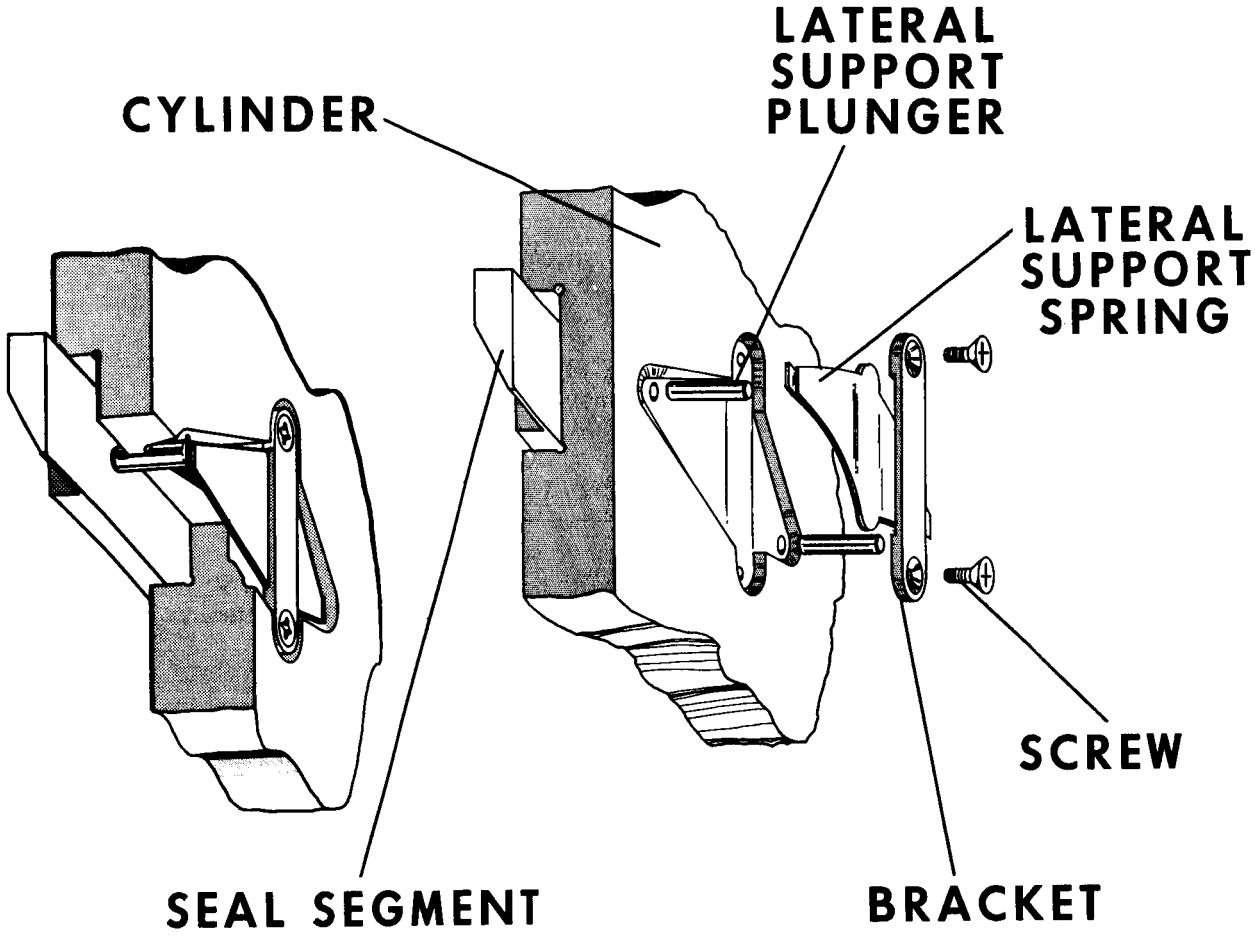

Figure 9 - 4 Assembly of Lateral Support